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THE PRACTICAL MANAGEMENT OF STEAM BOILERS.

Although there are numerous treatises and pocket companions for the workshop of the machinist and engineer, there has not been as yet, in general use, any good practical rules laid down to instruct the mechanic or the owner of engines, as to the proper management of steam boilers, an all important branch of Engineering; for however accurately finished and well got up an engine may be, unless it be carefully and properly attended to, it will very soon get into a state of disorder and derangement; and one of the principal points to be attended to is the steam boiler, the only part attended with danger, as the moving parts of a steam engine are not more dangerous than those of other machinery. From the numerous explosions that are now occurring, and the apparent recklessness of those connected with them, it behoves every one who is at all conversant with the subject to contribute his quota to the general stock of knowledge which has been published. This short treatise, therefore, however humble the effort may be, is intended to draw more attention to this very important subject.

In the following remarks, the usual causes immediately preceding explosions, besides those occuring from the waste of water, viz: incrustation, corrosion, furrowing, &c., are not treated of. It is the prevention of any or all of these causes that has been aimed it. We are fully persuaded that the adoption of what is here recommended is the only certain remedy for the prevention of these causes, which are secondary in their character; the *first* being negligence in not keeping the boiler clean, and in not keeping a true register of its condition from time to time, which record should always be made during the cleansing of the boiler.

The First Requisites of a Steam Boiler.

The first requisites of a steam boiler, are: that it be made of good material, of the best workmanship and of proper construction; that is, besides being of good plate, well punched, rivetted and stayed, it should be of proper dimensions in the various parts, so as to ensure more than is merely sufficient as to capacity and strength; to have manhole and mudholes and a safety valve, and a tested pressure of double the pressure intended to be carried by the boiler while doing its work. The safety valve should be of sufficient capacity to carry off freely all the steam that the boiler can make, at the tested pressure; the safety valve lever should work freely, and be accurately graduated, and mounted with a rope and pulleys, for lifting it from time to time, when necessary, to see that it is working freely, and that everything is satisfactory and safe. In setting a boiler, provision should be made for getting to any part of it for examination; and also to be very careful of those parts which are in contact with mortar. In some cases the shell has been found nearly eaten through, before being discovered, when it was in contact with lime in the brickwork. When the boiler rests on piers, a thick cast iron plate should be placed for the shell to rest upon; and even with this plate, unless kept perfectly dry, it will suffer from corrosion.

Who should be employed about a Steam Boiler.

It is of the utmost importance that the person employed to look after the boiler, as to its being supplied with a sufficient quantity of water, should be a person of previous good character; not "reckless", nor "careless," but an active, steady, and cautious person. If he has any aptitude for mechanics, so much the better. Caution, however, and a quick perception of his duties, are indispensible. His duties, though simple, are only second in importance and responsibility to those of his employer.

It is the duty of the attendant's chief, whoever he may be, employer, foreman, or engineer, to look round from time to time, to see that all is right, &c.; that the said attendant is doing his duty, by trying the guages and noting the times he may find too much or too little water in the boiler. He should also draw the attention of the attendant to the notes he has made of such cases of neglect or carelessness, and admonish him accordingly, taking no excuse whatever. The safety valve and pump should also be examined by him at the same time; first the guage cocks, next the safety valve and pump. Few explosions occur with such a system of inspection (along with the other inspections, to be treated of by and by), and all kept in perfect working order.

This inspection by the chief will only take up a few minutes at a time, perhaps not more than half an hour in the day when all is going right; and when anything is found wrong, although it take much

more time, he must give it ungrudgingly, if he cares for the safety of his establishment.

It is our invariable practice, on visiting any steam factory, to find out the attendant, and see the guages tried. On visiting a small establishment of this kind not long ago, we found the boiler surrounded with shavings and chips, and the steam up, and no person apparently in charge; and on trying the cocks, we found pure steam only. Having some little business with the principal, we went up stairs, and found him working away quite deliberately, as if his factory was run with horses and not with steam; no "make haste" in his case; and on mentioning that the boiler required water, he quietly moved down and started the pump, as unconcerned as if he thought it of no consequence. This same person had an explosion some years ago, when the boiler went through several buildings. Such a person is the last who should own or have any control of a steam boiler; nor should he ever be employed about a steam factory.

The mountings of a steam boiler comprise the guage cocks, safety valve, stop valve, sometimes a surface blow-off valve, pressure guage, manhole and mudholes. There are also used by some parties who really desire to have everything right, and spare no expense to have them so, several other devices, as water indicators and low water signals, which require some notice here.

Guage Cocks.

There are several kinds of guage cocks, and each kind in great variety;—so numerous, indeed, are their petty distinctions, that it would fill a volume to note their claims. All that is wanted in a guage cock is, that it will be of such construction as not to wear out soon from the using, and to discharge a good stream from the orifice, for the better distinguishing of the discharge of steam and the water therefrom.

There is one very good and durable kind of guage cock, the prominent feature in which is, that the aperture is opened and closed by two flat discs, one in the body of the guage cock behind the orifice, the other on the stem with an india rubber packing in the face, secured in a recess turned out to receive it, and moved back and forward by a small wheel on the end of the stem, the stem having a screw cut in it for this purpose. The packing can be renewed as it wears out, and when the discs get ground or cut, they can be readjusted in the lathe.

There should always be several spare guage cocks, so that the repairs can be done on them at any time suiting the convenience of the brass finisher. It looks bad to see faulty cocks, dropping and blowing where all should be tight and clean.

Water Indicators.

There is no indicator more reliable than the guage cock. The only advantage of an indicator is by having it correspond with the cocks: unless it does this, it is of no use. The advantage of an indicator is this, that its dial being always looking as it were in the face of the attendant, he cannot but take notice when the pointer is looking downwards, which is in fact telling him to try his guages; and if he is not at hand to observe this, when it gets a little lower down, it will let not only himself know, but all in the establishment, by blowing a loud and shrill whistle, and which will continue to blow until some one comes to its assistance, and puts matters right. A machine that will do this is of much importance, and renders valuable assistance itself in the management of steam boilers.

Duff's indicator and low-water signal is got up expressly for this purpose, and is every way effective.

Safety Valve.

The safety valve, as previously stated, should be accurately made, and of sufficient size to carry off the steam at a pressure equal to the tested pressure of the boiler, and should be placed on an accessible place, without any obstruction being in the way of getting to it. It is not necessary that the stem of the valve should have a link on the top embracing (loosely) the lever. When the lever is lifted by means of the rope and pulleys, the valve, if free, will be raised by the pressure of the steam; and if it does not rise, it is stuck fast on its seat, and the dampers must be shut down until this is adjusted; and if the steam be getting too high while this is being done—which the pressure guage will show—the fire must be drawn out.

Pressure Guage.

The pressure guage is very useful in such cases as the above, and also for getting up steam. This machine can also be detected when supposed to indicate incorrectly, by moving the counterbalance to the several notches on the lever of the safety valve. When it is right, the graduations on the dial and the notches on the lever will correspond. The pressure guage has now become a necessary adjunct to the steam boiler.

Blow-Off.

The blow-off valve should be used once in every twelve hours at least, blowing not less than one solid guage out at one time—having more than three solid guages when commencing to blow off—

and blowing off until leaving two solid guages. This valve, and its connection up to the boiler, should be carefully inspected every week; and it should be placed where it will not be damaged from the strongest part of the flame—say at any spot most convenient between the middle and back end of the boiler—where any sediment left after blowing off, will not injure the shell, as it would do if placed where the flame is strongest.

Stop or Steam Valve.

The stop valve is generally placed near the middle of the boiler, and if on a steam dome (or drum) so much the better. The modern globe form of valve is that most generally used both for this, the blow-off, and surface blow-off valves.

Surface Blow-Off Valve.

The surface blow-off valve should be used once in every hour, unless where the water is very pure and every way suitable for making steam. In cases where the water is muddy, frequent blowing off at the surface, besides lessening the deposit in the boiler, prevents foaming.

Getting up Steam.

In getting up steam in a boiler for the first time there is in most cases a good deal of trouble from the boiler foaming, sometimes in consequence of impurities in the water, but oftener with a new or newly repaired boiler from the oil that has been used by the boilermaker, inside the boiler, or from some other greasy matter on the tubes or plates.

To get over this difficulty, when very bad, it is advisable not to attempt to run the engine for any other purpose than working the pump, until it is stopped, which can be done by moving in the ball on the lever of the safety valve as far as it will go, and arranging the lever so that it will not rise more than four inches at the outer end at the most, and keep the pump at the boiler until the foaming ceases, which will in a new boiler probably continue for half a day. In filling the boiler it should have three solid guages, and this should be ascertained by the party himself, to whom the attendant is responsible, by trying the guages before the fire is started. We have known of several cases in which the boiler was fired up without any water in it, thereby damaging both the shell and the tubes.

Donkey Engines.

A donkey engine or steam pump is a very useful auxiliary to the pump attached to or in connection with the engine, for the purpose of putting water in the boiler when the engine is at rest, as may be required; and also to use in the event of the other pump getting deranged, which is a common occurrence, and the cause of much loss of time. The pump being the next thing in importance to the safety valve, requires close attention, from chips or other substances getting stuck in the valve seats, and causing the covers to be taken off to get them cleared out. It sometimes occurs that there will be no water found in the suction branch at all, when tried at the pet-cock, causing much annoyance; and when the cause has been found out, it may be a frog or a fish has been drawn in and stuck in one of the elbows of the pipe, showing the necessity of having a fine strainer on the mouth of the suction pipe. The proper way is to pump first up into a cistern ten feet or so above the engine or donkey pump, and have a fine strainer both before entering and before leaving the cistern. Numerous casualties can be traced to the defective state of the pump, it having become deranged while the attendant supposed all was right, and consequently neglected too long to see to its condition—some other more trifling matter probably having occupied his attention at the time. When the damage is done, the usual report first put out is, "Plenty of water in the boiler; he had tried the guage cocks a short time before, when there were nearly two guages."

Cleaning the Boilers.

When the boiler is to be cleaned, the first thing to be done is to draw out the fire; then to take the pressure gradually off the boiler by moving in the ball on the lever, finally tying up the lever, and then lifting the dampers. Three or four hours after this, take off the manhole cover, and run out the water. The boiler will be cool enough next morning for getting inside. The cleaning should be done every week in some localities (this, however, depends somewhat on the water used for steam, and the number of hours the engine is at work during the day); in other situations, once in two weeks; but never to exceed a month without cleaning, even with the best water—although in some places it is not done oftener than once in three months; but this is a bad and slovenly practice, and soon wears out the boiler by its getting burned below, from the mud laying on the opposite side of the plate. Even with good water for steam, the boiler should be cleaned at the end of every two weeks. "If it requires little, it will be the easier done;" and as every boiler should be inspected at the end of two weeks, the cleaning is necessary to get this done. The cleaning should be performed as follows: There must be at command a plentiful supply of water, under a good pressure. If in a city, this can be obtained from the water works, and in the most unfavorable localities a small hand fire engine is amply sufficient for this purpose.

The boiler is first thoroughly washed inside by means of a hose, held by a person inside the boiler, and directed to the sides of the shell, crown sheet, and tubes—one of the mudhole covers being taken off, and the water and mud run out at this hole and conveyed away in a spout, if necessary. A scraper is also introduced at this hole, for raising up any hard clay or other sediment that may have got stuck on the bottom. The legs of square fire-boxes to be scraped out in the same way. After being thoroughly washed with the hose, and scraped, a thin hard broom is now used, with which the shell is scrubbed and washed clean, a supply of water being admitted into the boiler to facilitate these operations. The tubes also are all to be cleaned out between each other by means of scrapers suited for the purpose, the scrapings being all broomed and washed forward to the mudhole, and partly run and partly drawn out at that orifice, along with the other sediment. The tubes to be also well cleaned internally at this time. The advantages gained by this simple process are incalculable. It prevents the boiler in every part where the flame strikes from being damaged, as these parts would be with a hard-baked cake of clay laying on them. It also keeps the heating surface up to its original power and efficiency; prevents to a great extent that troublesome condition of things inside the boiler, called "foaming," and is the means of discovering any undue wear of any part of the boiler, as soon as it shows itself.

Foam.

Foam is produced by the action of water, in a certain state of evaporation, upon some other substance or ingredient in the water, generally of a greasy nature. When a boiler is foaming, it is known by the nature of the discharge from the guage cocks; and also from the foam running over the cover of the safety-valve, finding its way through the cover by the stem of the valve. The lever of the safety-valve will also be observed to jump up and down every few minutes; and if there is a water-indicator on the boiler, the pointer will be seen to play all the fantastic tricks imaginable, and causing no little consternation to the attendant. Various are the devices that have been tried for this disorder. We have been told by a practical engineer that beef shanks and hoofs are sure preventives; and by another, that oiling the tubes was an excellent thing—both these parties had some reputation in their profession—so we need not wonder at the number of boilers we hear of having been burnt, and the number of passably good jobs that have been spoiled in the starting, under such circumstances—the boilers probably being damaged within forty-eight hours of their having been started. As already stated, the discharge from the guage cocks will show when the boiler is foaming, both from the peculiar sound it makes, and from its appearance to one acquainted with steam boilers. When the boiler is not foaming, the steam will be pure and free from froth in the upper cock, and the water nearly free from steam in the lower ones, and both the steam and water will issue from their respective cocks in nearly straight lines.

Remedy for this occasional Foaming.

When the boiler is foaming, the remedy is, to pump in plenty of water, until the upper cock shows a large proportion of water in the discharge. When this is obtained, blow freely from the safety-valve for about half-a-minute; repeat this at short intervals until the foaming ceases, which in most cases will be within an hour, keeping always in view to blow no more out from the safety-valve than you are putting in with the pump, besides giving enough for the engine.

The precautions to be observed in applying this remedy, are: to keep the pump at work until the upper guage cock shows this large proportion of water, before attempting to blow from the safety valve; otherwise, by blowing from the safety valve when there is already too little water in the boiler the crown sheet and tubes would immediately sustain damage.

An English work says of incrustation, that it has been found greatly to facilitate the cleansing of boilers if the plates were greased after every cleaning. For this purpose, in the Royal Gun Factories, at Woolwich, the refuse oil from the drip cans of the shafting is collected, and, after the boilers are cleaned, it is laid on inside with a brush. Although this does not stop the incrustation, it causes it to come off the plates much more rapidly, and is found to effect a great saving in time and expense in cleaning the boilers.*

Inspection.

In some cases it is found advantageous to have a running or weekly inspection of those parts of the boiler which are most exposed to the flame, and a thorough professional inspection for larger repairs once in six months. The weekly inspection comprises the fire box, tubes and shell, the feed and blow-off pipes and valves. In the morning before commencing to clean out the boiler, the outer part of the shell below the brickwork is broomed off,

*Of the two evils, incrustation and foaming, the former is the most disastrous, being an organic change in the material, while the latter is simply a deranged state of action; and at the Royal Gun Factories referred to, proper care will be taken of the boilers when lighting up, in the event of their foaming, which in all probability they will do.

and also the fire box and tubes; then the engineer examines carefully all the sheets exposed to the flame for cracks or blisters, and all round the seams of rivets. He also examines carefully the fire box and crown sheets, observing if there are any sprung rivets, or any other flaws to be seen, and noting the whole in a book kept for this purpose. He also goes inside the boiler to see that all is right there, and to examine any supposed flaw that may be reported to him by the scrubber-out, who preceded him in the inside operations.

Professional Inspection.

This should be made once in six months, or according to the usage of the boiler, with a practical boiler maker present, when all these points are more carefully examined, and determined upon as to what is sufficient and what is not sufficient for the next six months; also the repairs that may be necessary on the several parts that require to be repaired, and a full report made of the whole, and submitted for the approval of the head or superintendent of the establishment. Where such a system of cleaning and inspections have been carried out, it has been attended with the best results, and has given the greatest satisfaction. In our own experience, where there are eight boilers, we have found it necessary to have the cleaning and inspection weekly. Each boiler has a heating surface of sixty horse-power, with the usual pressure of eighty pounds on the square inch. The boilers have been in operation for the last six years, working day and night (equal to twelve years ordinary use). The fuel used is coal, and the chimnies are 100 feet high; consequently the heat and flame that they have been subjected to has been intense; so much so, that the water evaporated per minute with open dampers was nearly one and a half instead of one and a tenth cubic feet—the quantity due to a sixty horse power boiler per minute. The water, too, at all times muddy, at certain seasons excessively so, and carrying just so much lime as to cake and form a crust on the shell and tubes. In this case, without the cleaning and inspection herein recommended, these boilers would probably not have run three years, until requiring such extensive repairs as to be nearly equal to new boilers; and it is quite probable that from the frequency and extent of the repairs required, without such cleaning and inspection, they would have fallen far short of the requirements of the establishment.

We shall conclude these remarks by several others, gleaned from various sources, bearing upon and corroborating the views here put forward.

Boiler Explosions.

In the month of January, 1866, there occurred in the United States no less than eleven different explosions, by which no less than 490 lives have been lost, and for which no cause can be assigned; 21 wounded, and for which no cause can be assigned; making a total of 511 without any ascertained cause.

"It may be well," says the *Mechanic's Magazine*, "to place the following paragraph on record: Negligence is too frequently the cause of boiler explosions. One of the enginemen engaged at the Gospel Oak Colliery, Tipton, was sent to prison on Friday morning, for placing in jeopardy the lives of about sixty miners. He had neglected to examine the boilers, as he ought to have done; and early on Friday morning, when they were waiting to go down to the pit, the boiler plates were seen to be red-hot, and it was, as it is described, almost a miracle that no explosion took place."

The same journal says: "The time has gone by when an explosion was regarded as the result of mysterious agency. It is pretty well known now, that but two causes can lead to the bursting of a steam boiler under the conditions of legitimate working. These are simply congenital weakness, owing to bad materials or an imperfect method of construction; or induced weakness, the result of over-heated plates; or corrosion. More than 80 per cent. of the explosions which occur yearly, are the result of this last cause. If we take a hypothetical case, of three boilers of precisely the same form and construction, worked under precisely the same conditions, and exposed to like causes of deterioration, but carrying different pressures; the time when each will explode may be as certainly reckoned as the moment when a watch wound up to-night will be completely run down to-morrow. Suppose that one carry 100, another 75, and the last 50 lbs. of steam; the first may last five years, the second seven years, and the last nine or ten years, simply because the process of destruction may have so far weakened all the boilers that in five years they are incapable of carrying 100 lbs. of steam, but yet retain strength enough to carry 75 lbs. Therefore only that one carrying 100 lbs. will be destroyed then; the others will last until corrosion has done a little more, but they will go in turn. 'The end of all flesh is death,' and the end of all boilers is explosion. An old writer quaintly remarks that 'If a man live long enough, he will certainly die.' In the same way, if a boiler be worked long enough, it will explode, in spite of all the safety appliances which ever were or ever will be invented. At best, these can only provide for the occurrence of certain phenomena, which, without this provision, would cause an explosion; but they certainly cannot provide for the occurrence of *all* the phenomena which produce explosions. Until a safety valve or fusible plug is invented which shall stop a leak, or put on a patch, or arrest the progress of corrosion, neither one nor the other can prove its title to be esteemed as an infallible specific. The only certain preventive is careful, properly arranged and thorough inspection; and the reports of the steam-boiler societies prove its efficacy daily.

Experience goes to prove that fully as many explosions occur while the engine is in motion, or

when the boiler is under steam and the engine at rest, as at any other time.

It is almost impossible to trace any connection between the withdrawal of a portion of steam from a boiler and the consequent explosion of the latter. Could it be proved that the guage either rose or fell perceptibly, the case might be different; but the hand seldom moves instantaneously at least. The only remarkable phenomenon is, the sudden rise in the water in the glass guage; and this rise, from its character, would seem to denote a dilation of the whole body of fluid, not a mere foaming or priming, for the guage shows a rise of "solid water" invariably, and not foam, when the boiler is properly full. It is not likely that either of these explosions will be found to present any unusual phenomena; but the lesson which this conveys is not the less instructive. Inspection, and careful inspection alone, can secure safety; and the sooner steam-engine proprietors become convinced of the truth of this proposition, the better for the entire community." *

The *London Engineer* says: "Nearly all of the large number of boiler explosions, the causes of which are annually investigated by the engineers of the Manchester and Midland boiler associations, are clearly found to have occurred in consequence of either internal or external corrosion. In the case of locomotives—and they are now exploding sufficiently often to cause considerable anxiety—furrowing along a seam of rivets, or rather under the line of an overlap, is found to be the malady. In many boilers, especially on those lines where the hydraulic test is regularly applied, 'furrows' are discovered in time to prevent an explosion."

From the *American Artizan*:—"It is now generally understood that nearly every explosion of a steam boiler is the result of its own weakness. This may be owing either to originally defective material or construction, or to its original strength having been impaired by, or overheating of some of its parts; but the most prolific of all causes of explosion is corrosion. The best preventives are, therefore, a thorough examination and test of the boiler when new, a frequent and thorough periodical inspection after it has been in operation, and a searching investigation into and published report on the same of every explosion which occurs."

Steam-Boiler Assurance Company.

From the *London Engineer*:—"In the report of this association for 1864, we find the following information:

The total number of inspections, 23,849. Principal defects: fracture of plates and angle iron, 484; corrosion, 861; safety-valves out of order or overloaded, 507; pressure guages out of order, 297; water guages out of order, 364. Explosions, 43; and the number of deaths from explosions, 74. Iron works, mines and foundries furnishing the greatest proportion. Not a single explosion in a cotton mill is reported for 1864.

For 1865, the number of explosions is equal to the whole of those recorded for the three preceding years."

* We have seen a boiler give way without an explosion. The wasted portion in the bottom gave out, and the water ran gushing into the ash-hole.

The Midland Boiler Assurance Association.

"This association now has 1,839 boilers under either inspection or assurance, a rather larger number being under assurance than inspection. The association has been four years in existence, and it is only this year that Mr. E. B. Martin, the chief engineer, has had to report the explosion of a boiler under assurance. Even in this case the inspector had previously pointed out the defective condition of the boiler. No less than 7,172 inspections were made last year (1865), including 390 internal examinations, and 340 examinations of the interior of the flues. Mr. Martin has the care of some of the most dangerous boilers in the kingdom, judging from ordinary experience: 604 are in collieries, and 1,027 in iron works, and of the whole number no less than 1,495 are fired externally. The fact that among all this vast number of boilers not one life has been lost in four years, and that but one explosion has taken place, and that of a boiler of which the defects had already been pointed out, argues well for the care and diligence with which the inspection is carried out. It is also satisfactory to know that the association is paying regular dividends of ten per cent. per annum to its shareholders."

From the *Scientific American*:—"Not many months ago a law was passed, requiring all persons in charge of steam-boilers to have a certificate of competency from commissioners appointed to decide upon their fitness for their situations. In most instances, probably, this law has been complied with; in some others it has been wholly disregarded; in precisely how many, we have no means of ascertaining. Accident, however, has revealed one case at least where the person employed as engineer had no legal proof of his capacity, and, as the issue has proved, no mechanical fitness either: he blew himself up, with half-a-dozen others.

We shall not make unfounded charges, or be entangled in any assertion which we cannot prove; and we say that although this is the only case that we know of as being directly contrary to the provisions of the law for such cases made and provided, we can refer to countless instances where men have received testimonials of efficiency for engineering qualities which they did not possess: the five dollars of their employer bought them a character at second hand. Now, such a state of things may or may not be all right; it depends solely on the light in which they are scrutinized.

Engineering is a profession; it is not a trade, strictly speaking. It is not comprised in opening and shutting valves, or in scientific flirts with an oil-can, or in impertinence and vulgarity in demeanor when asked a civil question by an 'outsider.' It requires the closest attention, and both mental and physical labour, in order that the best possible results may be obtained. Whoever does less than to devote all his energies to his profession, robs his employer and cheats the world of science of discoveries which he might have made had he used the faculties nature gave him. Admitting engineering to be a science, and not a handicraft, we must then look for a high class of men to fill the situations—posts of honor and trust—which it opens out to the trade at large. No calling can be more productive of good results in respect to mental training, than the one under discussion.

Familiarity with steam machinery, most especially with the boilers, is apt to beget a confidence in the ignorant, which is not born of a knowledge of the dangers and exigencies which are continually occurring during their working, and which is the offspring of conceit and the grossest folly; but contact with steam, or thorough elementary knowledge of its constituents, theory of production and of action, only inclines the philosopher and the seeker after knowledge to be more patient and lowly in spirit when developing the mysteries of its sublime power, and applying the same to the arduous and monotonous task of doing the work of the world. A moment's reflection will show this to be the true light in which to view this matter; for in what other branch of the arts and sciences can we find one other person on whose sole charge is given so much responsibility and power? The magazine he guards may spread havoc and ruin about, if he impede the action of the feed, or neglect the valve which controls the surplus pressure. If he be upon the railroad or in the crowded city, the weal or woe of multitudes is committed to his keeping. If he be upon the sea, in the shock of battle, where iron-clad answers to iron-clad, and the sea frets itself hoarse in the vain effort to overwhelm them, the fate of nations even is in his power; the cause of truth, of justice, and human rights, or the reverse of all these, lies hidden in the lifting of a valve, the lubricating of a rod or shaft, or the loosening of a gland or screw at the proper time. If, therefore, each and every one in any way connected with the care of steam machinery resolves to raise the standard of their profession, the results will be apparent in a few years, in increased pecuniary benefit to themselves, and also to the arts and world of science generally.

In conclusion we would remark, that, we are an order, and it behoves every member of it to guard with a jealous care the privileges of his order; and this can be done only by the possession of superior qualifications for its duties, the result of a special education and training for the work; so that he may, in the moment of peril, display that presence of mind, the distinguishing characteristic of the educated * engineer, with the same coolness of judgment as when in conscious safety."

Now, since we are to have Confederation of the Provinces, it is probable that by our forming a closer and stronger connection with the mother country, some of those good rules and customs in regard to trade may be introduced among us; and of those that are the most necessary, the apprenticeship system by indenture should rank first in the list. The learned professions are everywhere protected, and why not they who spend seven of the best years of their lives in acquiring a knowledge of their business. In the States as well as in Canada, during periods of commercial prosperity, swarms of engineers spring up almost in a night, aided by the "under instructions" system. Half-taught runaways from other trades—such as locksmiths, pocker filers, and gas-pipe "engineers"—get smuggled in "under instructions;" so that the many accidents in connection with steam machinery need not cause much surprise. Accidents will occur with the most experienced—all are fallible; but the proportion would be much less, were a proper and more stringent system in force, for the better regulation of this especial branch of engineering. It is quite necessary to have a higher class of men for the work—responsible men, for responsible duty.

* What is meant here by "educated," is not the having taken degrees at any of the universities, but simply having learned under an indenture.

TWENTY-FIRST EXHIBITION OF THE PROVINCIAL AGRICULTURAL ASSOCIATION FOR UPPER CANADA.

The twenty-first annual Exhibition will be held in the City of Toronto, during the week commencing Monday, September, 24th, and closing on Friday, the 28th of same month.

As but few changes have been made in the RULES AND REGULATIONS as in force at last Exhibition, we deem it only necessary to publish an abstract thereof—the Rules and Prize List entire will shortly be extensively circulated in pamphlet form. Important changes have been made in some of the classes in the Arts and Manufactures department, we therefore publish that portion of the Prize List in full.

ABSTRACT OF RULES.

Membership.

1.—Members of local Societies constituted members of the Association, provided said Societies pay to Association funds not less than $1 for each of such members.

2.—Members of Board of Agriculture, Board of Arts and Manufactures, and Presidents and Vice-Presidents of Agricultural and Horticultural Societies are *ex officio* members. Payment of $1 constitutes an ordinary member, and $10 a life-member.

3.—Members can enter articles for competition in any or every department of the Exhibition.

Entries.

4.—None but members can compete, except in Ladies Work and Indian Work.

5.—Entries to be made on printed forms, and returned to the Secretary of the Board of Agriculture, with $1 for membership (except as otherwise provided) by the undermentioned dates:

6.—Horses, cattle, sheep, swine and poultry, by Saturday, August, 18th.

7.—For Blood-horses and pure-bred cattle to furnish pedigrees.

8.—Entries for grain, field roots, and other farm products, agricultural implements, and machinery and manufactures generally must be returned by Saturday, September, 1st.

9.—Entries for Horticultural Products, Ladies' Work, and the Fine Arts must be returned by Saturday, September 15th.

10.—Entries absolutely to be made by above-mentioned dates.

11.—Entries in live stock to be made by *bona fide* owners.

12.—Entries in all other classes to be made by the producers or manufacturers only.

13.—Competition open to the world, in all the departments, except fruit, class 28.

14.—Manufacturers requested to furnish statement of quantities they can supply, and price.

15.—No person allowed to enter more than one specimen of the same variety or pattern in the same section; and in the ARTS AND MANUFACTURES deparment, no exhibitor shall be awarded more than one prize in the same section of any class.

16.—No article can be entered as an *extra* for want of sufficient quantity or number, or similar defect, when of the same kind or variety as anything named in regular sections.

17.—Agricultural and horticultural products must be the growth of the present year. Articles awarded prizes at any previous Exhibition cannot compete for regular prizes this year, but may be awarded diplomas, if deserving.

18.—Entry cards, with class, section and number, furnished to exhibitors on entry being made.

Delivery of Goods.

19.—Specimens in Fine Arts to be delivered on the ground by Friday, the 21st September; all articles other than live stock, not later than Monday the 24th; and live stock, by Tuesday, the 25th, at 9 a.m. Early deliveries, however, are particularly requested.

20.—Exhibitors to deliver goods on Exhibition grounds at their own expense.

21.—Articles not accompanied by their owners, may be addressed to the Superintendent of the department to which they belong.

22. Superintendent of Grounds will inform exhibitors where goods will be placed.

23. Exhibitors to give personal attention to articles, where necessary; and at the close of exhibition take charge of the same.

24. No article or stock to be removed from the ground till Friday, at 2 p.m.

25. Directors will use every precaution, but will not be responsible for loss or damage to articles on exhibition.

Steamboats, Railroads, Customs.

26.—Arrangements for reduced fares will be made with steamboat and railroad proprietors.

27.—Arrangements will be made with Customs Department for free entry of foreign goods for exhibition.

Admission to the Grounds.

28.—Issue of season tickets of admission discontinued.

29. Each Member receives four single admission tickets. Life-Members, Delegates and Members of the Press, furnished with badges or tickets.

30. Entry tickets on animals or articles will admit the party in charge on entering grounds.

31.—Necessary attendants upon stock and articles will receive tickets, good at the *exhibitors' gate* only.

32. Admission tickets to Non-Members on and after Tuesday at 25 cents each, Children half-price. Carriages and horses not admitted.

Judges, and their Duties.

33.—Judges appointed by the Council of the Association.

34. Judges to present their circular of appointment on their arrival at the grounds.

35.—Judges in Fine Arts meet at the Secretary's Office, in Crystal Palace, at 9 a.m. on Monday, the 24th September; and in Manufactures, at 9 a.m. on Tuesday, the 25th. The Judges in the Agricultural department meet at 9 a.m., at their committee room, on Tuesday, the 25th.

36.—No interested person to act as a judge.

37.—Judges may award extra prizes.

38.—In Arts and Manufactures department, diplomas may be awarded in addition to first money prizes.

39.—Judges may use their discretion in awarding prizes, in absence of sufficient competition, &c.

40.—Awards to be plainly written in Judge's book.

41.—No person allowed to interfere with Judges.

42.—Judges required to act with rigid impartiality.

43.—Upon discovery of any fraud or deception, the Council to have power to withhold payment of prizes awarded.

Delegates and Annual Meeting.

44.—Delegates and Members of Press to report themselves at Secretary's office.

45.—Annual meeting to be held on Friday, 28th September, at 10 a.m.

46.—County Societies may obtain portions of prize wheat.

General Superintendent.

47. General Superintendent to have office on the grounds, and have entire supervision.

Paying the Premiums.

48. Treasurer will commence paying premiums on Saturday, September 29th, on the grounds.
49.—Secretaries of Departments will give orders on Treasurer for amount of prizes.
50.—Orders made payable to *order*, and must be endorsed.
51. Premiums not paid on the Saturday will be forwarded by the Treasurer, on receipt of proper instructions.

Miscellaneous.

52. Provender provided at cost price.
53. Auctioneers will be on the ground after premiums are awarded, for the purpose of selling any animal or article owners may wish to dispose of.
54.—Owners of prize animals or articles to furnish information, if required to do so.

PROGRAMME FOR THE WEEK.

1. MONDAY, Sept. 24th, will be devoted to the awarding of prizes in Fine Arts, and to the final receiving of other articles for exhibition, and their proper arrangement. None but officers and members of the Association, judges, exhibitors, and necessary attendants will be admitted.

2. TUESDAY, 25th.—The judges in all classes but Fine Arts will meet in their respective committee rooms, at 9 a.m., and will commence their duties forthwith. On receiving their class books, they will be also furnished with the blank prize tickets, which they shall fill up and affix in each section, so soon as they shall have finally determined their awards. The First Prize Tickets will be Red; the second Blue; the third Yellow; the fourth White; Extras, Green. On completing the class, the Judges will report to the Secretary of the proper department. The main Exhibition Building will be closed all this day for the purpose of affording the Judges an opportunity for discharging their duties properly. Non-members admitted to the grounds this day on payment of 25 cents each time.

3. WEDNESDAY, 26th. — The Judges of the various classes will complete their awards as early in the day as possible. All the buildings and grounds will be open to visitors. Admission this day the same as yesterday.

4. THURSDAY, 27th. — Admission this day the same as yesterday. The President will deliver his address, from the Grand Stand, at 3 o'clock.

5. FRIDAY, 28th.—The regular Annual Meeting of the Directors of the Association, for the purpose of electing officers, deciding upon the place of holding the next exhibition, and other business, will take place at 10 a.m., in the committee room. At 2 p.m., the Exhibition will be considered officially closed, after which no one will be admitted into the Crystal Palace, and exhibitors may commence to take away their property. Admission to-day the same as yesterday.

6. SATURDAY, 29th.—The Treasurer will commence paying the premiums at 9 a.m. Exhibitors will remove all their property from the grounds and buildings. The gates will be kept closed as long as necessary, and none will be admitted except those who can show that they have business to attend to.

PRIZE LIST FOR 1866.

ARTS AND MANUFACTURES DEPARTMENT.

(No Exhibitor will be awarded more than one prize in the same section of any class, in this Department.)

(*Competition open to the World.*)

CLASSIFICATION.

Class 35—Cabinet Ware and other Wood Manufactures.
" 36—Carriages and Sleighs, and parts thereof.
" 37—Chemical Manufactures and Preparations.
" 38—Decorative and useful Arts; Drawings and Designs.
" 39—Fine Arts.
" 40—Groceries and Provisions.
" 41—Ladies' Work.
" 42—Machinery, Castings, and Tools.
" 43—Metal Work (miscellaneous), including Stoves.
Class 44—Miscellaneous, including Pottery and Indian Work.
" 45—Musical Instruments.
" 46—Natural History.
" 47—Paper, Printing and Bookbinding.
" 48—Saddle, Engine Hose, Trunkmakers' Work and Leather.
" 49—Shoe and Bootmakers' Work, and Leather.
" 50—Woollen, Flax, and Cotton Goods; Furs, and Wearing Apparel.

Class 35—Cabinet Ware and other Wood Manufactures.

Sect.	Cabinet Ware.	$	c.
1.	Bed-room Furniture, set of	15	00
	2nd do	8	00
2.	Centre Table	8	00
	2nd do	4	00
3.	Drawing-room Sofa	8	00
	2nd do	4	00
4.	Drawing-room Chairs, set of	8	00
	2nd do	4	00
5.	Dining-room Furniture, set of	15	00
	2nd do	8	00
6.	Inlaid Work, of Canadian woods	8	00
	2nd do	4	00
7.	Side Board	8	00
	2nd do	4	00
8.	Wardrobe	6	00
	2nd do	3	00
	Miscellaneous.		
9.	Coopers' Work	6	00
	2nd do	3	00
10.	Corn Brooms, 1 doz	2	00
	2nd do	1	00
11.	Handles for Tools of Carpenters, Blacksmiths, Gunsmiths, Watchmakers, &c., collection of	8	00
	2nd do	4	00
12.	Joiners' Work, assortment of	10	00
	2nd do	6	00
13.	Machine-wrought Moulding and Flooring, 100 feet of each	6	00
	2nd do	3	00
14.	Turning in Wood, collection of specimens	6	00
	2nd do	3	00
15.	Turned Hollow Wooden Ware, assortment of	6	00
	2nd do	3	00
16.	Veneers from Canadian woods, undressed	8	00
	2nd do	4	00
17.	Veneers from Canadian woods, dressed and polished	10	00
	2nd do	6	00
18.	Wash Tubs and Pails, factory made, three of each	4	00
	2nd do	2	00
19.	Willow Ware, six specimens	4	00
	2nd do	2	00
20.	Extra entries		

Class 36—Carriages and Sleighs, and Parts thereof.

Sect.		$	c.
1.	Axle, wrought-iron	4	00
	2nd do	2	00
2.	Bent Shafts, half-a-dozen	3	00
	2nd do	2	00
3.	Bows for Carriage Tops, two sets	3	00
	2nd do	2	00
4.	Buggy, double-seated	10	00
	2nd do	6	00
5.	Buggy, single-seated	8	00
	2nd do	5	00
6.	Buggy, trotting	6	00
	2nd do	4	00
7.	Carriage, two-horse, pleasure	20	00
	2nd do	12	00
8.	Carriage, one-horse, pleasure	12	00
	2nd do	8	00
9.	Carriage, Child's	4	00
	2nd do	2	00

Class 36—Continued.

		$	c.
10.	Cariage Hubs, Rims and Felloes, and machine-made Spokes, the best assortment.	7	00
	2nd do	4	00
11.	Dog Cart	7	00
	2nd do	4	00
12.	Express Waggon	7	00
	2nd do	4	00
13.	Sleigh, two-horse, pleasure	15	00
	2nd do	8	00
14.	Sleigh, one-horse, pleasure	10	00
	2nd do	6	00
15.	Springs, one set Steel Carriage	5	00
	2nd do	3	00
16.	Sulky, trotting	5	00
	2nd do	3	00
17.	Wheels, one pair of Carriage, unpainted	4	00
	2nd do	2	00
18.	Extra entries		

Class 37—Chemical Manufactures and Preparations.

Sect.		$	c.
1.	Colours, assortment, in Oil, Pulp and Powder	6	00
	2nd do	4	00
2.	Essential Oils, assortment of	6	00
	2nd do	4	00
3.	Glue, 14 lbs	3	00
	2nd do	2	00
4.	Medical Herbs, Roots and Plants, native growth	12	00
	2d do	7	00
5.	Oils—Linseed	6	00
	2nd do	4	00
6.	Oil, Neat's foot, half gallon	2	00
	2nd do	1	00
7.	Printing Inks, an assortment	5	00
	2nd do	3	00
8.	Pitch, 30 lbs	5	00
	2nd do	3	00
9.	Resin, 30 lbs	5	00
	2nd do	3	00
10.	Tar, 1 gallon	3	00
	2nd do	2	00
11.	Turpentine, Spirits of, 1 gallon	5	00
	2nd do	3	00
12.	Extra entries		

Class 38—Decorative and Useful Arts, Drawings and Designs.

Sect.		$	c.
1.	Carving in Wood, Figure subject	15	00
	2nd do	8	00
2.	Carving in Wood, decorative	10	00
	2nd do	6	00
3.	Drawing of Machinery, in perspective	6	00
	2nd do	4	00
4.	Decorative House Painting	6	00
	2nd do	4	00
5.	Engraving on Wood, with proof	6	00
	2nd do	4	00
6.	Engraving on Copper, with proof	6	00
	2nd do	4	00
7.	Goldsmiths' Work	6	00
	2nd do	4	00
8.	Gold and Silver Leaf	4	00
	2nd do	3	00
9.	Geometrical Drawing of Engine or Mill Work, coloured	6	00
	2nd do	4	00
10.	Lithographic Drawing, plain	6	00
	2nd do	4	00

Class 38—Continued.

11.	Lithographic Drawing, coloured	$6 00
	2nd do	4 00
12.	Mantelpiece in Marble	10 00
	2nd do	6 00
13.	Mathematical, Philosophical and Surveyors' Instruments, collection of	15 00
	2nd do	10 00
14.	Modelling in Plaster	6 00
	2nd do	4 00
15.	Monumental Headstone	6 00
	2nd do	4 00
16.	Picture Frame, Ornamented Gilt	8 00
	2nd do	5 00
17.	Penmanship, business hand, without flourishes	4 00
	2nd do	2 00
18.	Penmanship, Ornamental (not Pen and Ink Pictures)	4 00
	2nd do	2 00
19.	Sign Writing	5 00
	2nd do	3 00
20.	Silversmiths' Work	6 00
	2nd do	4 00
21.	Stained Glass, collection of specimens	12 00
	2nd do	8 00
22.	Extra entries	

Class 39—Fine Arts.

Professional List—Oil* (Originals.†)

Sect.		$ c.
1.	Animals, from life	12 00
	2nd do	7 00
2.	Historical or general figure subject	12 00
	2nd do	7 00
3.	Landscape, Canadian subject	12 00
	2nd do	7 00
4.	Landscape or Marine Painting, not Canadian subject	10 00
	2nd do	6 00
5.	Marine Painting, Canadian subject	12 00
	2nd do	7 00
6.	Portrait	10 00
	2nd do	6 00
7.	Still life	10 00
	2nd do	6 00

In Water Colours.

8.	Animals, from life	7 00
	2nd do	5 00
9.	Historical or general Figure subject	7 00
	2nd do	5 00
10.	Landscape, Canadian subject	7 00
	2nd do	5 00
11.	Landscape or Marine Painting, not Canadian subject	7 00
	2nd do	5 00
12.	Marine View, Canadian subject	7 00
	2nd do	5 00
13.	Portrait	6 00
	2nd do	4 00
14.	Still life	6 00
	2nd do	4 00

Pencil, Crayon, &c.

15.	Crayon, coloured	6 00
	2nd do	4 00

* Professional Artists are to be understood as those who paint or teach for a livelihood, or as a matter of profit, or who habitually sell or offer for sale their productions; or who have at any previous time habitually painted or taught for a livelihood or for profit.

† Evidence of originality to be furnished by the exhibitor, whenever required by the Judges or the Committee.

Class 39—Continued.

16.	Crayon, plain	$6 00
	2nd do	4 00
17.	Crayon Portrait	6 00
	2nd do	4 00
18.	Pencil Drawing	6 00
	2nd do	4 00
19.	Sepia	6 00
	2nd do	4 00

Professional List—Oil (Copies).

20.	Animals, from life	6 00
	2nd do	4 00
21.	Historical or general figure subject	6 00
	2nd do	4 00
22.	Landscape	6 00
	2nd do	4 00
23.	Marine Painting	6 00
	2nd do	4 00
24.	Still life	5 00
	2nd do	3 00

In Water Colours.

25.	Animals, from life	4 00
	2nd do	3 00
26.	Historical or general figure subject	4 00
	2nd do do	3 00
27.	Landscape	4 00
	2nd do	3 00
28.	Marine View	4 00
	2nd do	3 00
29.	Still life	4 00
	2nd do	3 00

Pencil, Crayon, &c.

30.	Crayon, coloured	4 00
	2nd do	2 00
31.	Crayon, plain	4 00
	2nd do	2 00
32.	Pencil Drawing	4 00
	2nd do	2 00
33.	Sepia	4 00
	2nd do	2 00

Amateur List—Oil* (Originals.†)

34.	Animals, from life	8 00
	2nd do	5 00
35.	Historical or general figure subject	8 00
	2nd do	5 00
36.	Landscape, Canadian subject	8 00
	2nd do	5 00
37.	Landscape or marine painting	8 00
	2nd do	5 00
38.	Marine painting, Canadian subject	8 00
	2nd do	5 00
39.	Portrait	8 00
	2nd do	5 00
40.	Still life	8 00
	2nd do	5 00

In Water Colours.

41.	Animals, from life	7 00
	2nd do	5 00
42.	Historical or general figure subject	7 00
	2nd do do	5 00
43.	Landscape, Canadian subject	7 00
	2nd do do	5 00
44.	Landscape or marine painting, not Canadian view	7 00
	2nd do	5 00

* Amateur artists are to be understood as those who *do not* paint or teach for a livelihood, or for profit, or habitually sell or offer for sale their productions; and who have not at any time heretofore done so.

† Evidence of originality to be furnished by the exhibitor, whenever required by the judges or the committee.

Class 39—Continued.

45.	Marine view, Canadian subject	$7 00
	2nd do	5 00
46.	Portrait	6 00
	2nd do	4 00
47.	Still life	6 00
	2nd do	4 00

Pencil, Crayon, &c.

48.	Crayon, coloured	5 00
	2nd do	3 00
49.	Crayon, plain	5 00
	2nd do	3 00
50.	Crayon portrait	5 00
	2nd do	3 00
51.	Pencil drawing	5 00
	2nd do	3 00
52.	Sepia	5 00
	2nd do	3 00

Amateur List—Oil (Copies).

53.	Animals, from life	5 00
	2nd do	3 00
54.	Historical or general figure subject	5 00
	2nd do do	3 00
55.	Landscape	5 00
	2nd do	3 00
56.	Marine painting	5 00
	2nd do	3 00
57.	Portrait	5 00
	2nd do	3 00
58.	Still life	5 00
	2nd do	3 00

In Water Colours.

59.	Animals, from life	4 00
	2nd do	2 00
60.	Historical or general figure subject	4 00
	2nd do do	2 00
61.	Landscape	4 00
	2nd do	2 00
62.	Marine view	4 00
	2nd do	2 00
63.	Portrait	4 00
	2nd do	2 00
64.	Still life	4 00
	2nd do	2 00

Pencil, Crayon, &c.

65.	Crayon, coloured	4 00
	2nd do	2 00
66.	Crayon, plain	4 00
	2nd do	2 00
67.	Crayon portrait	4 00
	2nd do	2 00
68.	Pencil drawing	4 00
	2nd do	2 00
69.	Sepia	4 00
	2nd do	2 00

*Photography.**

70.	Ambrotypes, collection of	6 00
	2nd do	4 00
71.	Photograph portraits, collection of, in duplicate, one set coloured	10 00
	2nd do	6 00
72.	Photograph portraits, collection of, plain	8 00
	2nd do	5 00
73.	Photograph landscapes and views, collection of	8 00
	2nd do do	5 00

* In coloured photographs the name of the artist who colours, as well as the name of the photographer, to be attached to all specimens.

Class 39—Continued.

74.	Photograph portrait, finished in oil	$8 00
	2nd do	5 00
75.	Photograph portrait, finished in Indian Ink	6 00
	2nd do do	4 00
76.	Photograph portrait, finished in water col's	6 00
	2nd do do	4 00
77.	Extra entries	

Class 40—Groceries and Provisions.

Sect.		$ c.
1.	Barley, Pearl, 25 lbs	3 00
	2nd do	2 00
2.	Barley, Pot, 25 lbs	3 00
	2nd do	2 00
3.	Bottled Fruits, an assortment, manufactured for sale	6 00
	2nd do do	4 00
4.	Bottled Pickles, an assortment, manufactured for sale	6 00
	2nd do do	4 00
5.	Buckwheat Flour, 25 lbs	3 00
	2nd do	2 00
6.	Chickory, 20 lbs., prepared	3 00
	2nd do do	2 00
7.	Indian Corn Meal, 25 lbs	3 00
	2nd do	2 00
8.	Oatmeal, 25 lbs	3 00
	2nd do	2 00
9.	Sauces for table use, an assortment, manufactured for sale	6 00
	2nd do do	4 00
10.	Soap, one box of common	4 00
	2nd do	3 00
11.	Soaps, collection of assorted fancy	6 00
	2nd do do	4 00
12.	Starch, 12 lbs. Corn	2 00
	2nd do	1 00
13.	Starch, 12 lbs. Flour	2 00
	2nd do	1 00
14.	Starch, 12 lbs. Potato	2 00
	2nd do	1 00
15.	Sugar, 20 lbs. Sorghum	5 00
	2nd do	3 00
16.	Sugar, 1 loaf Refined	5 0
	2nd do	3 00
17.	Tobacco, 14 lbs. Canadian manufactured	5 00
	2nd do do	3 00
18.	Wheat Flour, 50 lbs.	7 00
	2nd do	5 00
19.	Extra entries	

Class 41—Ladies' Work.*

Sect.		$ c.
1.	Bead Work	3 00
	2nd do	2 00
	3rd do	1 00
2.	Braiding	3 00
	2nd do	2 00
	3rd do	1 00
3.	Cone Work	3 00
	2nd do	2 00
	3rd do	1 00
4.	Crochet Work	3 00
	2nd do	2 00
	3rd do	1 00
5.	Embroidery in Muslin	3 00
	2nd do	2 00
	3rd do	1 00

* All articles entered in this class must be strictly the production of ladies; and no prizes will be awarded but in conformity with this rule.

Class 41—Continued.

6.	Embroidery in Cotton	$3 00
	2nd do	2 00
	3rd do	1 00
7.	Embroidery in Silk	3 00
	2nd do	2 00
	3rd do	1 00
8.	Embroidery in Worsted	3 00
	2nd do do	2 00
	3rd do do	1 00
9.	Flowers, Silver Wire	2 00
	2nd do	1 00
	3rd do	0 50
10.	Flowers, Feathers	2 00
	2nd do	1 00
	3rd do	0 50
11.	Gloves, 3 pairs	2 00
	2nd do	1 00
	3rd do	0 50
12.	Guipure Work	3 00
	2nd do	2 00
	3rd do	1 00
13.	Hair Work	3 00
	2nd do	2 00
	3rd do	1 00
14.	Knitting	3 00
	2nd do	2 00
	3rd do	1 00
15.	Lace Work	3 00
	2nd do	2 00
	3rd do	1 00
16.	Machine Sewing, Family	2 00
	2nd do	1 00
	2rd do	0 50
17.	Mittens, 3 pairs Woollen	2 00
	2nd do	1 00
	3rd do	0 50
18.	Moss Picture	3 00
	2nd do	2 00
	3rd do	1 00
19.	Moss Work	2 00
	2nd do	1 00
	3rd do	0 50
20.	Needle Work, Ornamental	3 00
	2nd do do	2 00
	3rd do do	1 00
21.	Netting, Fancy	3 00
	2nd do	2 00
	3rd do	1 00
22.	Plait for Bonnets or Hats, of Canadian Straw	3 00
	2nd do	2 00
	3rd do	1 00
23.	Quilt, Silk	2 00
	2nd do	1 00
	3rd do	0 50
24.	Quilt, Patch-work	2 00
	2nd do	1 00
	3rd do	0 50
25.	Shell Work	2 00
	2nd do	1 00
	3rd do	0 50
26	Shirt, Gentleman's	3 00
	2nd do	2 00
	3rd do	1 00
27.	Socks, 3 pairs Woollen	2 00
	2nd do	1 00
	3rd do	0 50
28.	Stockings, 3 pairs of Woollen	2 00
	2nd do do	1 00
	3rd do do	0 50
29.	Tatting	3 00
	2nd do	2 00
	3rd do	1 00

Class 41—Continued.

30.	Wax Flowers	$6 00
	2nd do	4 00
	3rd do	2 00
31.	Wax Fruit	6 00
	2nd do	4 00
	3rd do	2 00
32.	Wax Shells, a collection of	3 00
	2nd do do	2 00
	3rd do do	1 00
33.	Worsted Work	3 00
	2nd do	2 00
	3rd do	1 00
34.	Worsted Work, Fancy, for framing	3 00
	2nd do do do	2 00
	3rd do do do	1 00
35.	Worsted Work, Raised	3 00
	2nd do do	2 00
	3rd do do	1 00
36.	Wreath, Flower	2 00
	2nd do	1 00
	3rd do	0 50
37.	Wreath, Seed	2 00
	2nd do	1 00
	3rd do	0 50
38.	Extra entries	

Class 42—Machinery, Castings, and Tools.

Sect.		$ c.
1.	Blacksmith's Bellows	4 00
	2nd do do	3 00
2.	Castings for General Machinery	15 00
	2nd do do do	8 00
3.	Cast Wheel, Spur or Bevel, not less than 50 lbs. weight	8 00
	2nd do	5 00
4.	Castings for Railways, Railroad Cars, and Locomotives, assortment of	20 00
	2nd do do	12 00
5.	Cordwood Sawing Machine, horse-power	10 00
	2nd do do	6 00
6.	Cordwood Sawing Machine, hand-power	8 00
	2nd do do do	5 00
7.	Hand-Power Weaving Loom	6 00
	2nd do do	4 00
8.	Edge Tools, an assortment	20 00
	2nd do do	12 00
9.	Engine, Steam, stationary, of one to four-horse power, in operation	15 00
	2nd do do	10 00
10.	Engine, Steam, stationary, five-horse power and upwards, in operation	25 00
	2nd do do	15 00
11.	Fire Engine, Steam, in operation on the ground	25 00
	2nd do	15 00
12.	Fire Engine, hand-power	15 00
	2nd do do	10 00
13.	Machines for Planing and Drilling Metals	12 00
	2nd do do	8 00
14.	Pump, in metal	6 00
	2nd do	4 00
15.	Refrigerator	6 00
	2nd do	4 00
16.	Saws, an assortment	10 00
	2nd do do	6 00
17.	Sawmill, Steam in operation	20 00
	2nd do	12 00
18.	Sash and Moulding Machines	12 00
	2nd do do	8 00
19.	Sugar and Coffee Mills	6 00
	2nd do	4 00

Class 42—Continued.

20.	Scales, Platform	$5 00
	2nd do	3 00
21.	Scales, Counter	3 00
	2nd do	2 00
22.	Shingle-Splitting Machine	6 00
	2nd do do	4 00
23.	Skates, an assortment of	6 00
	2nd do	4 00
24.	Tools for working in Metals, assortment of	12 00
	2nd do	7 00
25.	Turning Lathe	7 00
	2nd do	4 00
26.	Valves and Gearing for working Steam expansively, either in model or otherwise; principle of working to be the point of competition	12 00
	2nd do	7 00
27.	Extra entries	

Class 43—Metal Work (Miscellaneous), including Stoves.

Sect.	*Miscellaneous.*	$ c.
1.	Coppersmiths' Work, an assortment	8 00
	2nd do	5 00
2.	Engineers' Brass Work, an assortment	8 00
	2nd do	5 00
3.	Fire Arms, an assortment	8 00
	2nd do	5 00
4.	Files, collection of Cast steel	3 00
	2nd do	2 00
5.	Fire-proof Office Safe	8 00
	2nd do	5 00
6.	Gas Fixtures, an assortment	7 00
	2nd do	4 00
7.	Iron Fencing and Gate, ornamental	8 00
	2nd do	5 00
8.	Iron Work from the hammer, ornamental	7 00
	2nd do	4 00
9.	Iron Work, ornamental cast	7 00
	2nd do	4 00
10.	Lock—Combination Bank Lock	8 00
	2nd do	5 00
11.	Locksmiths' Work, an assortment	8 00
	2nd do	5 00
12.	Malleable Hardware Manufactures, an assortment	8 00
	2nd do	5 00
13.	Nails, 20 lbs. Pressed	6 00
	2nd do	4 00
14.	Nails, 20 lbs. Cut	6 00
	2nd do	4 00
15.	Plumbers' Work, an assortment	8 00
	2nd do	5 00
16.	Screws and Bolts, an assortment	6 00
	2nd do	4 00
17.	Sheet Brass Work, an assortment	8 00
	2nd do	5 00
18.	Tinsmiths' Work, an assortment	6 00
	2nd do	4 00
19.	Tinsmiths' Lacquered Work, an assortment	6 00
	2nd do do do	4 00
20.	Wire Work, an assortment	6 00
	2nd do	4 00
	Stoves.	
21.	Cooking Stove, for wood	6 00
	2nd do	4 00
22.	Cooking Stove, for coal	6 00
	2nd do	4 00
23.	Furniture for Cooking Stove, one set	5 00
	2nd do do	3 00

Class 43—Continued.

24.	Hall Stove, for wood	$5 00
	2nd do	3 00
25.	Hall Stove, for coal	5 00
	2nd do	3 00
26.	Parlour Stove, for wood	5 00
	2nd do	3 00
27.	Parlour Stove, for coal	5 00
	2nd do	3 00
28.	Parlour Grate	5 00
	2nd do	3 00
29.	Parlour Fire-place complete, including setting of grate so as to economise fuel; and arrangement for ventilating room	10 00
	2nd do do	6 00
30.	Extra entries	

Class 44—Miscellaneous, including Pottery and Indian Work.

Sect.	*Miscellaneous.*	$ c.
1.	Brushes, an assortment	6 00
	2nd do	4 00
2.	Model of a steam Vessel	6 00
	2nd do	4 00
3.	Model of a Sailing Vessel	6 00
	2nd do	4 00
	Pottery.	
4.	Filterer for water	3 00
	2nd do	2 00
5.	Pottery, an assortment	8 00
	2nd do	5 00
6.	Sewerage Pipes, stoneware, assortment of sizes	10 00
	2nd do	6 00
7.	Stench Traps for Drains, Stoneware	3 00
	2nd do do	2 00
8.	Stoneware, an assortment	10 00
	2nd do	6 00
9.	Slates for roofing	8 00
	2nd do	5 00
10.	Indian work	
11.	Extra entries	

Class 45—Musical Instruments.

Sect.		$ c.
1.	Harmonium	12 00
	2nd do	8 00
2.	Melodeon	6 00
	2nd do	4 00
3.	Organ, Church	30 00
	2nd do	20 00
4.	Piano, Grand	20 00
	2nd do	12 00
5.	Piano, Square	15 00
	2nd do	10 00
6.	Piano, Cottage	10 00
	2nd do	6 00
7.	Extra entries	

Class 46—Natural History.

Sect.		$ c.
1.	BIRDS—Collection of Stuffed Birds of Canada, classified, and Common and technical names attached	8 00
	2nd do	6 00
2.	FISHES—Collection of Native Fishes, stuffed or preserved in spirits, and common and technical names attached	8 00
	2nd do	6 00

Class 46—Continued.

3.	Insects—Collection of Native Insects, classified, and common and technical names attached	$8 00
	2nd do	6 00
4.	Mammalia and Reptiles of Canada, stuffed or preserved in spirits, classified, and common and technical names attached	8 00
	2nd do	6 00
5.	Minerals—Collection of Minerals of Canada, named and classified	8 00
	2nd do	6 00
6.	Plants—Collection of Native Plants, arranged in their natural families, and named	8 00
	2nd do	6 00
7.	Stuffed Birds and Animals of any country, collection of	8 00
	2nd do	6 00
8.	Extra entries	

Class 47—Paper, Printing, Bookbinding and Type.

Sect.		$ c.
1.	Bookbinding (blank-book), assortment of	5 00
	2nd do do do	3 00
2.	Bookbinding (letter-press), assortment of	5 00
	2nd do do do	3 00
3.	Letter-press Printing, plain	5 00
	2nd do do	5 00
4.	Letter-press Printing, ornamental	5 00
	2nd do do	3 00
5.	Letter-press Printing—Posters, plain and ornamental	5 00
	2nd do do	3 00
6.	Millboard and Strawboard, assortment	5 00
	2nd do do	3 00
7.	Paper Hangings (Canadian paper), one dozen rolls, assorted	6 00
	2nd do	4 00
8.	Papers—Printing, Writing, and Wrapping, one ream of each	6 00
	2nd do do	4 00
9.	Papers—Blotting and Coloured, one ream of each	6 00
	2nd do do	4 00
10.	Pocket-books, Wallets, &c., an assortment	6 00
	2nd do do	4 00
11.	Extra entries	

Class 48—Saddlic, Engine Hose, Trunkmakers' Work, and Leather.

Sect.	*Saddlery, &c.*	$ c.
1.	Collars, an assortment	5 00
	2nd do	3 00
2.	Engine Hose and Joints, 2¾ inches diameter, 50 feet of copper rivetted	8 00
	2nd do do	5 00
3.	Harness, set of double carriage	8 00
	2nd do do	5 00
4.	Harness, set of single carriage	7 00
	2nd do do	4 00
5.	Harness, set of team	5 00
	2nd do	3 00
6.	Harness, set of Express	6 00
	2nd do	4 00
7.	Hames, carriage or gig, best assortment	5 00
	2nd do do do	3 00
8.	Hames, team or cart, best assortment	5 00
	2nd do do do	3 00

Class 48—Continued.

9.	India Rubber Belting, Engine-Hose, &c., an assortment	$8 00
	2nd do do	5 00
10.	Leather Machine Belting, an assortment	8 00
	2nd do do do	5 00
11.	Saddle, Ladies' full quilted	8 00
	2nd do do	5 00
12.	Saddle, Ladies' quilted safe	6 00
	2nd do do	4 00
13.	Saddle, Gentlemen's full quilted	7 00
	2nd do do	4 00
14.	Saddle, Gentlemen's plain shaftoe	6 00
	2nd do do	3 00
15.	Trunks, an assortment	8 00
	2nd do	5 00
16.	Valises and Travelling Bags, an assortment	5 00
	2nd do do	3 00
17.	Whips, an assortment	5 00
	2nd do	3 00
18.	Thongs, an assortment	3 00
	2nd do	2 00
	Leather.	
19.	Belt Leather, 30 lbs	4 00
	2nd do	3 00
20.	Brown Strap and Bridle, one side of each	4 00
	2nd do do	3 00
21.	Carriage Cover, two skins (whole)	4 00
	2nd do do	3 00
22.	Deer skins, three dressed	3 00
	2nd do do	2 00
23.	Harness Leather, two sides	4 00
	2nd do do	3 00
24.	Hog Skins for saddles, three	4 00
	2nd do do	3 00
25.	Patent Leather, for carriage or harness work, 20 feet	6 00
	2nd do do	4 00
26.	Skirting for saddles, two sides	4 00
	2nd do do	3 00
27.	Extra entries	

Class 49.—Shoe and Bootmakers' Work, Leather, &c.

Sect.	*Boots, &c.*	$ c.
1.	Boots, Ladies', an assortment	7 00
	2nd do do	4 00
2.	Boots, Gentlemen's sewed, an assortment	7 00
	2nd do do	4 00
3.	Boots, Machine made, an assortment	7 00
	2nd do do	4 00
4.	Boots, pegged, an assortment	5 00
	2nd do do	3 00
5.	Boot and Shoemakers' Tools, an assortment	8 00
	2nd do	5 00
6.	Boot and Shoemakers' Lasts and Trees, an assortment	8 00
	2nd do	5 00
7.	Shoemakers' Pegs, an assortment	4 00
	2nd do do	3 00
8.	Shoes, India Rubber, an assortment	6 00
	2nd do do	4 00
	Leather.	
9.	Calf Skins	3 00
	2nd do	2 00
10.	Calf Skins, grained	3 00
	2nd do	2 00
11.	Calf Skins, two morocco	3 00
	2nd do do	2 00

Class 49—Continued.

12.	Cordovan, two skins	$3 00
	2nd do	2 00
13.	Dog Skins, two dressed	3 00
	2nd do do	2 00
14.	Kip Skins, two sides	3 00
	2nd do	2 00
15.	Kip Skins, grained	3 00
	2nd do	2 00
16.	Linings, six skins	3 00
	2nd do	2 00
17.	Patent Leather for bootmakers, 20 ft	6 00
	2nd do do	4 00
18.	Sheep Skins, six coloured	3 00
	2ad do do	2 00
19.	Sole Leather, two sides	3 00
	2nd do	2 00
20.	Upper Leather, two sides	3 00
	2nd do do	2 00
21.	Upper Leather, grained, two sides	3 00
	2nd do	2 00
22.	Extra entries.	

[Oak-tanned Leather must be entered under the head of Extras, and not in competition with Hemlock-tanned.]

Class 50.—Woollen, Flax and Cotton Goods; Furs and Wearing Apparel.*

Sect.		$ c.
1.	Bags, from flax or hemp, the growth of Canada, one dozen	8 00
	2nd do	5 00
2.	Bags, one dozen cotton	4 00
	2nd do	3 00
3.	Blankets, woollen, one pair	6 00
	2nd do do	4 00
4.	Calico, unbleached, one piece	5 00
	2nd do do	3 00
5.	Caps, Cloth, an assortment	5 00
	2nd do do	3 00
6.	Carpet, woollen, one piece	8 00
	2nd do	5 00
7.	Carpet, woollen stair, one piece	7 00
	2nd do	4 00
8.	Carpet, rag, one piece	5 00
	2nd do	3 00
9.	Cassimere Cloth, from Merino wool, one piece	7 00
	2nd do	4 00
10.	Cloth, fulled, one piece	7 00
	2nd do	4 00
11.	Cloth, broad, one piece	7 00
	2nd do	4 00
12.	Counterpanes, two	5 00
	2nd do	3 00
13.	Cordage and Twines, from Canadian flax or hemp, assortment of	10 00
	2nd do	6 00
14.	Check for horse collars, one piece	6 00
	2nd do	4 00
15.	Drawers, factory made, woollen, 6 pairs	5 00
	2nd do do do	3 00
16.	Flannel, factory made, one piece	5 00
	2nd do do	3 00
17.	Flannel, not factory made, one piece	5 00
	2nd do do	3 00
18.	Flannel, scarlet, one piece	5 00
	2nd do	3 00

* All fabrics must be entered by the actual manufacturer, or weaver; and no prizes will be otherwise awarded.

Class 50—Continued.

19.	Fur Cap and Gloves	$5 00
	2nd do	3 00
20.	Fur Sleigh Robes—Buffalo, Wolf and Raccoon, an assortment	15 00
	2nd do	8 00
21.	Gloves and Mits, 3 pairs of each, factory made, woollen	4 00
	2nd do	2 00
22.	Gloves and Mits of any leather, an assortment	5 00
	2nd do	3 00
23.	Horse Blankets, two pairs	5 00
	2nd do	3 00
24.	Kersey for horse clothing, one piece	5 00
	2nd do do	3 00
25.	Linen Goods, one piece	5 00
	2nd do	3 00
26.	Oxford Grey Cloth, one piece	5 00
	2nd do	3 00
27.	Overcoat of Canadian Cloth	5 00
	2nd do	3 00
28.	Satinet, black, one piece	6 00
	2nd do	4 00
29.	Satinet, mixed, one piece	5 00
	2nd do	3 00
30.	Shawls, home made	4 00
	2nd do	2 00
31.	Sheepskin Mats, dressed and coloured, an assortment	6 00
	2nd do	4 00
32.	Shirts, factory made, three of each, woollen and Angola	5 00
	2nd do	3 00
33.	Silk and Felt Hats	5 00
	2nd do	3 00
34.	Stockings and Socks, factory made, woollen, three pairs of each	4 00
	2nd do	2 00
35.	Stockings and Socks, factory made, mixed woollen and cotton, three pairs of each.	4 00
	2nd ddo do do	2 00
36.	Suit of Clothes of Canadian Cloth	8 00
	2nd do do	5 00
37.	Tweed, Winter, one piece	6 00
	2nd do	4 00
38.	Tweed, Summer, one piece	6 00
	2nd do	4 00
39.	Twine, linen and cotton, an assortment	3 00
	2nd do do	2 00
40.	Winsey, checked, one piece	5 00
	2nd do	3 00
41.	Woollen Cloths, Tweeds, &c., an assortment	10 00
	2nd do do do	6 00
42.	Woollen Shawls, Stockings, Drawers, Shirts and Mits, an assortment	10 00
	2nd do	6 00
43.	Yarn, white and dyed, one pound of each	3 00
	2nd do do do	2 00
44.	Yarn, fleecy woollen, for knitting, one pound	3 00
	2nd do	2 00
45.	Yarn, Cotton, two pounds	3 00
	2nd do	2 00
46.	Yarn, linen, two pounds	3 00
	2nd do	2 00
47.	Linen Goods—for the best 6 varieties of Linen Goods, manufactured in Canada, from Canadian grown flax; each specimen of cloth to contain not less than 12 yards	60 00
	2nd do	40 00
48.	Extra entries	

Board of Arts and Manufactures
FOR UPPER CANADA.

TRADE MARKS.

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

(*Continued from page* 116.)

Joseph Burnett, & Co., per Samuel Stanton, of Manchester, N. H., U. S., "Cocoaine." Vol. A, folio 123, No. 154. Dated March 24th, 1866.

Hall & Buckell, New York, U. S., "Sozodont." Vol. A, folio 119, No. 201. Dated April 16th, 1866.

D. A. Ansell, per Perkins & Stephens, "The Extincteur or Portable Fine Engine." Vol. A, folio 122, No. 204. Dated April 17th, 1866.

R. P. Hall & Co., per E. Overy, "Vegetable Sicilian Hair Renewer." Vol. A, folio 120, No. 218. Dated April 23rd, 1866.

W. T. Atkinson, per A. B. Fairbanks, "Tooth Paste." Vol. A, folio 121, No. 228. Dated April 28th, 1866.

Transactions of Societies.

TORONTO MECHANICS' INSTITUTE.

Evening Classes.

A public meeting was held on the evening of May the 1st, for distribution of prizes to the most successful pupils of the various classes. The President, F. W. Cumberland, Esq., stated the business of the meeting, and called upon the Secretary to read the Class Committee's report.

The statistics of the classes will be found in the annual report of the Directors.

The meeting was addressed by Dr. Connon, Chairman of the Class Committee; Rev. Dr. Scadding, examiner in French; Mons. Pernet, teacher in do; Mr. Baigent, teacher of Ornamental Drawing; and, in conclusion, by the President, who urged upon the pupils and youths, generally, the importance of learning while young, that it may be a source of strength and consolation to them as long as they live. The meeting was an exceedingly interesting one.

Annual Meeting.

The annual meeting of this very popular and useful institution was held on the 14th ultimo (May). We select a few of the most interesting passages of the report of the retiring Board of Directors, for publication:—

"The directors of the Toronto Mechanics' Institute, in pursuance with the requirements of the constitution, beg leave to present their report for the year ending the 1st May, 1866, being the thirty-fifth annual report of the proceedings of the Institute."

"For the purpose of comparison, and with a view to a clear understanding of the relative value of the figures, and progress of the institution, the respective returns have as far as possible been tabulated in combination with those of previous years.

1.—Of the Membership.

At the date of the last annual report the total membership numbered	969
From which deduct for subsequent deaths, removals, and withdrawals	437
Carried forward from the roll of previous year	532
Members and subscribers added during the year	446
Total number on the books 1st May, 1866	978

The classification of members for 1865-6, and previous years has been as follows:—

	1865.	1864.	1863.	1862.	1861.	1860.
Adult member	643	668	704	698	745	449
Subscribers	239	202	199	264	143	67
Life members	78	81	81	81	83	86
Honorary mem's	18	18	18	18	18	18
Total	978	969	1002	1061	989	620

The directors express their inability to account for the failure to secure a membership commensurate with the wealth and population of Toronto, and go on to say that—

"It would be inconsistent with the proper independence and status of such an institute to seek any support partaking of an eleemosynary character; but the directors can scarcely bring themselves to doubt that a more intimate and wider knowledge of the work that the Institute is doing, and the many and great advantages it affords, would lead to a more general appreciation and more active support of its labors.

2.—Of Income and Expenditure.

"The receipts of the year have been as follows:—

	1865. $ c.	1864. $ c.
Balance cash on hand 1st May, 1865	92 07	90 83
New members and subscribers	780 75	808 00
Old members and subscribers	1408 50	1349 75
Rents from all sources	2663 86	3168 41
Fines and fees	98 87	76 27
Newspapers sold	65 90	42 16
Catalogues sold	15 40	13 86
Lost books paid for	4 15	8 50
Fees from pupils of evening classes	432 00	286 00
Northern Railway Co., for evening classes	100 00	100 00
Profits of entertainments	1380 05	739 90
Sundries	10 77	27 00
	$7053 42	$6718 67

The expenditure of the year has been as follows:—

	1865. $ c.	1864. $ c.
Books	486 61	350 95
Newspapers and Magazines	306 82	208 96
Stationary & blank books	5 40	43 75
" "	35 70	
Binding	174 10	171 65
"	77 37	

Printing and advertising	52 49	98 87
Postage	131 89	120 43
Fuel	378 36	422 47
Gas	845 90	860 50
Water	80 00	80 00
Insurance	116 00	136 00
Repairs	254 86	309 71
"	162 50	
Salaries of officials	1,649 88	1,356 65
Additional assistance	131 48	139 88
Classes, teachers & prizes	446 00	335 45
Interest on mortgage	1,104 00	1,104 00
" to bank	36 12	64 10
Sundries	52 30	82 32
	$6,477 88	$5,835 70

After a lengthy analysis of the income and expenditure, and of the membership account, the institute is thus congratulated on its financial position:—

"By the care and prudence of many years the assets of the Institute in real estate, lands, buildings, library, furniture, &c., &c., represent a surplus over all liabilities, amounting on valuation probably to about $28,000, a sufficient guarantee for the stability of the Institution, and a cheering incentive towards such further efforts as shall gradually but finally relieve it from the impediments of debt, and secure for it a full and vigorous freedom."

3.—Of the Library.

"The directors have continued to give anxious and liberal consideration to this important department. The outlay in the purchase of books and of newspapers and magazines, has been considerably larger during the past year than in 1864.

The number of books in the Library at the date of the last annual report was	6554
Added during the year by purchase	447
Bound up from Reading Room	55
Total	7,056
Lost and worn out during the year	98
Total now in the Library	6,958

The wear and tear of the books has become very serious, and the directors anticipating considerable future outlay in maintaining the present stock in available condition would strongly appeal to the members to assist in protecting the books from injury."

4.—Of the Reading Room.

"The Reading Room continues to attract a very large and regular attendance of members. It is replete with the best journals of the Provinces and of Great Britain and the United States, whilst the supply of the periodical literature of the day is on the most complete and liberal standard. By reference to appendix B, it will be seen that the reading-room files present a list of journals and periodicals unequalled by that of any other reading-room in the province, available at so small a subscription.

During the past year the system of circulating the reviews and magazines has been established with a success which evinces an appreciation of the measure and warrants its continuance. Under this system the standard periodicals of the day (including *Blackwood, Westminster, Quarterly, North British and Edinburgh Reviews, Cornhill, Temple Bar, Macmillan, London Society, Dublin University, Chambers*, &c., &c.,) are circulated at a charge of only two cents.

The very large and increasing attendance of ladies in the library, and the evident propriety of making due provision for their comfort, has induced the directors to initiate the necessary steps for establishing, at an early date, a 'Ladies' Reading-room,' to be open for such a limited number of hours each day as may hereafter be determined, in connection with which it may be found expedient to adopt the principle of 'family tickets.'"

5.—Of the Evening Classes.

The report very properly brings forward the practical importance and value of this department of the operations of the institute, and that with the highest satisfaction the—

"Directors are enabled to report that the winter session, just closed, has been marked by decided success, alike in relation to the efficiency of the staff of teachers engaged, to the number of pupils enrolled, to the strict regularity of attendance, to the testimony of the examiners as to the satisfactory progress made in the respective studies, and finally to the fact that these gratifying results have been attained without recourse to any assistance from the general funds of the Institute."

"The classes, of which a list is subjoined, were opened on the 16th October, and closed by examination on the 2nd of April, forty lessons of two hours each having been comprised in the session:

Subject.	Teacher.	No. Pupils. 1865-6	1864-5	1863-4
Book-keeping Penmanship	Mr. A. G. Springer Mr. J. D. Odell	61	46	58
Arithmetic and Mathematics	T. A. Bryce, M. A	20	14	6
English	Rev. H. S Cartwright	19	8	21
French	Mons. E. Pernet	16	18	10
Elocution	Mr. R. Lewis	10	5	nil
Phonography	Mr. R. Lewis	43	nil	nil
Architectural and Mecha'ical Drawing	Mr. J. Smith	16	7	20
Landscape, figure and Ornamental Drawing	Mr. Baigent	15	7	nil
Total number of Pupils	1865-6	200	105	115
" "	1864-5	105		
Increase 1865-6		95		

The following is the list of the examiners and the list of prizes:

Subject.	Examiners.	Award of Prizes
Bookkeeping	Mr. A. Gemmel	1st, William Martin.
"	"	2nd, T. McCleary.
Penmanship	Mr. A. Gemmel	1st, A. Williams.
"	"	2nd, W. Carrier.
Arithmetic and Mathematics.	C. W. Connon	1st, R. Smith.
"	"	2nd, S. Bartlett.
English	Mr. R. Lewis	1st, James Bell.
"	"	2nd, J. Greenlees.
"	"	Hon. men., Miss McGee.*
French	Rev Dr. Scadding	1st, A. Brown.
"	"	2nd, Walter Copp.

* Placed for first prize in English, but disqualified by regulations.

Architectural & Mechanical Drawing	Mr. J. G. Howard	1st, G. Hunter.
"	"	2nd, G. A. Aird.
"	"	Hon. men., D. Roberts.
"	"	Hon. men., D. Rogers.
Landscape, Figure and Ornamental Drawing	Mr. H. Martin	1st, Miss Smith.
"	"	2nd, Miss Mathews.
"	"	Hon. men., Miss Bartlett.†
"	"	Miss Webster.
"	"	W. Hamilton.

The receipts and expenditures connected with the evening classes have been as follows :—

Amount received from pupils other than apprentices of the Northern Railway company		$432 00
Amount received from Northern Railway company in aid of the classes		100 00
		$532 00
Paid Teachers	394 00	
" Printing Advertising	12 08	
" Prizes	52 20	
" Fuel, Gas, &c.	70 00	
	528 28	
	$ 3 72	

"Thus, whilst the classes of the preceding year, comprising 105 pupils, involved a deficit to the Institute of $95 01, the last session, with 200 pupils, yielded a surplus of $3 72."

6.—Of the Reunions and other Entertainments.

The directors report during the year six Reunions under the direction of Mr. Humphries; four Promenade Concerts; and three Oratorias, organized and directed by Mr. Carter; a Lecture by the Hon. T. D'Arcy McGee; night Dramatic Readings in the Institute by Mr. Geo. Vandenhoff, besides twenty-two similar readings by the same gentleman, under the auspices of the Institute, in seventeen other cities and towns in Canada West; and the Arts Exhibition.

The total number of admissions at the entertainments was 26,373; receipts $5095 42; expenditure $3715 37; total profits, $1380 05.

7.—Of the Exhibition.

"There has been no branch of the labors of the Institute which has given greater satisfaction to the directors, or which seems more entirely to have commended itself to general support and approval than that of the exhibition of the past season; for although previous efforts of a like character had been most encouraging, that now under revision was more than usually attractive and gratifying, and peculiarly successful in its results."

"The collection of the fine and decorative arts, of mechanical and manufacturing skill, of foreign antiquities and curiosities, of general articles of vertu, and of embroidery and other lady's work, were alike extensive, interesting, and valuable, affording useful information in a most attractive form and unmixed delight to a larger number of visitors than had ever before attended at the Institute."

"The exhibition was open for twelve days, viz., from the 20th March to the 2nd April—the number of visitors 9,204, and the amount received a trifle in excess of $800."

"For these satisfactory results the directors fees that their grateful acknowledgments are due to the generosity and public spirit of the exhibitors, (a list of whom is published in appendix,) who, regardless of personal inconvenience and sacrifice, contributed to the collection with a genuine liberality worthy of the warmest recognition.

"Nor should the directors omit to particularize the services most kindly rendered by a committee of ladies, (see appendix "C,") who, with the zealous assistance of a large number of lady contributors, succeeded in forming a collection of their handiwork of peculiar excellence; and to the taste and energy with which this department of the exhibition was managed may be attributed much of the success attending the whole enterprise."

"The directors believing that the resources contributary to such exhibitions have not by any means been yet exhausted, and believing also that they exercise a most useful purpose and wholesome influence, would recommend their continuance; for the experience of the past seems to show that they grow steadily in public favour, and in each succeeding year provide in a measure for their own success by provoking new efforts in the various departments of art and mechanical skill which they are intended to illustrate, and by inciting new generosity on the part of contributors."

"The directors close their report by congratulating the members on the continued efficiency and extending usefulness of the institute. It has won its way through many early and great difficulties to public confidence and favor, and though still oppressed by a serious debt, it fulfils its functions to general approval. The obstacles already surmounted, the success already achieved, and the warm (although still insufficient) support and interest it attracts, are alike incentives to such further vigorous support as shall at no distant day relieve it from the pressure under which it still labors, and set it free to occupy a wider sphere and to realize a more perfect fulfilment of the objects and duties it professes."

Finally.

"The directors bear testimony to the continued zeal and fidelity of the excellent secretary of the institute, Mr. Longman, to whose ability, experience and discretion the institute is under increasing obligations."

(Signed.) FRED. CUMBERLAND,
President.

The report was adopted and the following office-bearers for the ensuing year elected: *President*, F. W. Cumberland; *First Vice-President*, John J. Withrow; *Second Vice-President*, W. P. Marston; *Treasurer*, Wm. Edwards; *Directors*, F. W. Coate, John Cowan, H. E. Clarke, Henry Langley, J. H. Richey, Daniel Spry, B. Langley, Richard Lewis, J. Carty, Wm. Hamilton, Jr., W. A. Foster, LL.B., and W. H. Sheppard.

† Placed for second prize in Drawing, but disqualified by regulations.

Selected Articles.

CHEMISTRY BY THE FIRESIDE.

(*Continued from page* 122.)

No. 7.—History of Chemistry.

In our last article we gave a sketch of the history of Alchemy as the forerunner of chemistry. It was not till about two hundred years ago that chemistry had made much real progress. The mode of distilling so as to obtain alcohol was discovered some time previous by the Arabians. But about the year 1650, several discoveries were made, such as some of the properties of the metals and various salts. Sulphuric and nitric acids were among the important discoveries. The first man who formed it into a regular science was Stahl, a German chemist, although the great principles on which he based his science were entirely erroneous, as has since been proved. He thought that all bodies contain a combustible element, which all inflammable bodies *lost* on being burned. This element could also be regained from other more inflammable bodies. This imaginary element he called *Phlogiston*. This theory continued for one hundred years as the basis of all that was known in the science of chemistry. After the discovery of oxygen by Priestly, the astonishment of chemists was great when it was proved that burning bodies did not *lose* in weight by the giving out of the imaginary phlogiston, but actually *increased* in weight by the union of oxygen with the combustible body. When it was found that weighing a piece of iron wire and then burning it in oxygen, the product of their combustion was equal to the weight of the iron and oxygen together, the whole phlogistic theory fell to the ground, and chemistry started on a sure basis never to be shaken.

The science now advanced rapidly. The various elements were soon discovered and their properties investigated. New chemical compounds, unknown before, were added to the list of known substances. At the beginning of the present century, galvanism, electricity and magnetism rapidly developed themselves in the hands of their masters. At the present time, there is nothing which has escaped the hands of the chemist. Everything has been analysed and its properties published to the world. The advantages we enjoy from these results are impossible to be related. They reach the humblest cottage in the land, adding a thousand fold to the comforts and luxuries of life wherever civilized society exists.

In our next article we will commence the examination of some of the elements.

No. 8.—Oxygen.

We are now prepared to examine the elements separately.

The greatest discovery made in Chemistry was that of oxygen by Dr. Priestly, in 1774. He was a clergyman, but fond of experimenting in Chemistry. Like many others, his discovery was one of pure accident, but in his hands it was turned to account. While among his apparatus one day, he put some red precipitate, which we now know to be composed of oxygen and the metal quicksilver, into a glass retort, placed the heat of a lamp to it and put the open end of the retort under a jar, inverted and full of water. Presently he saw bubbles of air, as he supposed, displacing the latter until it was full of this air instead of water. Now what could this new substance be? Before this time all gaseous bodies were supposed to be only different forms of common air. Dr. Priestly, finding that he had a new substance to deal with, called it *vital air*, because it could be breathed freely, which was not the case with other gaseous bodies then known. He found also that a candle would burn very fast in it. This was the first really analytical experiment ever recorded, and is the starting point we have in chemistry. The old theory of *phlogiston* of which we spoke in the last article was at once exploded, and instead of an inflammable body having anything to impart from its own substance while burning, as the old chemists supposed, Priestly's discovery led to the important fact that a body increases in weight during combustion. Let us see. If we take a candle weighing one ounce, light it and put it into a jar of pure oxygen, whose weight is also known, the candle will burn up very rapidly by the oxygen uniting with the candle, and the jar will be filled with various gases which will, when weighed, be equal to the original weight of the oxygen and candle combined. If we take a piece of iron and burn it up in oxygen, as we call it, not a particle of the iron is lost, but it has received oxygen enough for this purpose, and the ashes left will actually weigh more than the iron before it was burned. The same result may be proved in a thousand different ways. In presenting before you the principal elements, we shall make use, as far as possible, of the most simple experiments and the most familiar illustrations of every day life.

Four things are necessary to be remembered as we pursue the study, each of which you should be prepared to answer as we proceed.

1st. Where is the element under discussion found in nature.

2d. How can it be obtained in a separate state?

3d. What are its properties?

4th. With what other element will it combine, and what kind of compounds will it form?

Oxygen is the most widely connected with the other elements. About one-fifth part of the atmosphere is composed of oxygen, while eight-ninths of the waters of the globe are pure oxygen. It enters into the composition of almost everything, so that it exists as you will see, in larger quantities than any other element. In the language of chemistry, almost everything in nature is an oxide.

Suppose now, you wish to obtain oxygen in a pure state. You have only to select some substance containing oxygen, place it in a retort the same as Dr. Priestly did, apply heat, and place its mouth under a glass jar or large mouthed bottle filled with water and inverted in a tub of water. Oxygen can be separated from any compound by the application of heat. Red lead, which is an oxide of lead, so treated, will part with its oxygen and leave you the metal lead. Chlorate of potash is commonly used for the purpose, because it contains a large amount of oxygen, and is easily separated from the other elements. Binoxide of manganese, which is found in the earth in some

places, may be used for the same purpose, simply by taking an old gun barrel, stopping up the vent, put the manganese into the barrel, and fit a gutta percha or lead tube to the muzzle and invert it under the jar as before, and the gas will pass into it as before. These are the two methods usually employed by chemists for obtaining oxygen. If you throw a piece of nitrate of potash (saltpetre) on to some burning coals, it will burn with great fury on account of the large amount of oxygen which it contains.

Suppose now we look at a jar of oxygen gas. We would at first be disappointed. We could see nothing different from common air. It is transparent as air, and has never been reduced to a liquid state. It has no taste or smell, and weighs only a trifle more than common air. If you will regard air as only oxygen diluted with another gas, you will have some idea of what oxygen is. Its most remarkable property is its energy in supporting combustion. Anything that will burn in common air, will burn with great splendor in oxygen. Light a candle and put it in a jar of oxygen and it will burn all down in a few minutes. The most splendid experiment is that of burning a steel watch spring in a jar of oxygen. The sparks fly from the steel just as you have seen them fly from a piece of steel when a blacksmith heats a piece of iron in his forge to a white heat and then exposes it to the air. It then burns in air like a piece of wood, the sparks flying in all directions, because the oxygen of the air combines with it rapidly, and reduces it to an oxide of iron. You see then, that the more rapidly oxygen is united to a combustible body, the more rapid the combustion. You can now explain the reason why you blow into the fire to make it burn, and why the blacksmith blows into his forge a large quantity of air by means of bellows, and why the dentist and the jeweler use the little mouth blow-pipe to solder gold and silver. It is to furnish a large quantity of oxygen which exists abundantly in the air so as to unite rapidly with the combustible body. If you plunge a lighted candle into water it will instantly go out, because it is deprived of oxygen. You may place the lighted candle in a jar of carbonic acid gas, and it will go out instantly for the same reason.

There is one more important principle. It sustains animal life. Every time you draw air into your lungs, the oxygen in that portion of air unites with the blood in the lungs and serves to purify and replenish it, while at the same time it unites with the impure portions of the blood which are thrown off every time you force the air out of your lungs. Thus your lungs are like the blacksmith's forge, furnishing heat to the system by the combustion of the oxygen. If you should live in pure oxygen you would live too fast, just as the candle burns too fast in pure oxygen. Inflammation would kindle up somewhere in your system and you would soon die. Vegetable matter on the other hand, is constantly giving out oxygen, while decaying matter absorbs it.

Such are some of the properties of this wonderful substance. If you would render yourself familiar with it, you should read this article over and over again, and then you will readily enjoy what may be said of it hereafter.

No. 9.—Nitrogen.

The second element to which we will call your attention is nitrogen, or as it is sometimes called, azote. This element is found in the atmosphere and comprises about one fifth of that substance. It is a constituent of animal substances, and of some vegetables, such as the cabbage. It is lighter than oxygen or air, so that in order to keep in an open jar you must turn it bottom upwards. If you should light a candle and invert a tumbler over it, you would find that in a minute or two, the candle would go out. The candle made use of what oxygen there was in the air of the tumbler to support combustion, leaving nothing but nitrogen, which being lighter than air, floated into the top of the vessel asagas. If you now carefully place the candle relighted, into the inverted tumbler, it will go out just as quick as if it had been dipped into water, showing that nitrogen is still there and that it will not support combustion like oxygen. This is a very simple and instructive experiment.

A more scientific way of obtaining nitrogen is to put some pieces of phosphorus in a jar placed over a little water. Set the phosphorus on fire, and as that has great affinity for oxygen (a fact which you already know from seeing how finely a match will burn that has a little too much phosphorus on it,) it will use up the oxygen of the air in the jar, by its combining phosphorus and forming phosphoric acid, which at first will fill the vessel like a dense white cloud, and afterwards be absorbed by the water, leaving the nitrogen in the jar nearly pure. There are other methods adopted by chemists, but this will answer our present purpose because it is easily understood.

We want to know something about its properties. In looking at a jar of nitrogen you would be disappointed at seeing nothing different from common air in appearance. It is without color, taste, or smell, and is, when combined, always in the form of a gas. It will not support combustion as we have already seen by placing a candle in it. If you should put a mouse in a jar of nitrogen he would die instantly for the want of oxygen, and not from any injurious effects of the nitrogen.

Nitrogen combines with oxygen to form the atmosphere, but not chemically. Its great office is to dilute the oxygen so that we should not live too fast, and so that our iron utensils would not rust too fast, and our wood and lamps burn too fast. You are already familiar with many of the properties of air. Water dissolves a considerable portion of air. All water-breathing animals depend on the air dissolved in the water for life. If you put a fish in a tub of water, he will swim round lively enough so long as there is air enough in the water, but as soon as he has made use of a portion of it, he will become uneasy and swim around the sides of the vessel and sometimes poke his nose above the water for some air, and will soon die unless the water is changed. A fish can be drowned in air the same as an animal can be drowned in water. When you catch a fish and throw him on the ground, he opens and shuts his gills the same as in the water in order to breathe, but very soon his gills become dry and he cannot breathe. Some fish, like the eel, have a slimy skin, and the gills will perform their duty much longer. So you see how important the oxygen of

the atmosphere is, and how necessary that it should be properly tempered with nitrogen to render it fit to breathe and to burn our wood and coal, and lamps. If you boil water the air is driven off, and fish could not live in water that has been boiled.

There are many compounds of nitrogen and oxygen in different properties, the most important of which is the powerful substance known as nitric acid. This is made by distilling saltpetre, which is a nitrate of potash. Nitrogen also combines with hydrogen and forms ammonia. If you burn a lock of wool, you smell a peculiar odor. This is the union of nitrogen and hydrogen in the wool, and which forms ammonia. The laughing gas is a protoxide of nitrogen. It has recently been employed to inhale for extracting teeth. It has the peculiar property of raising the spirits of some persons in a remarkable manner.

Thus we have noticed two elements and some of the compounds. Hold what you have and catch what you can, should be your motto in studying chemistry.

No. 10.—Hydrogen.

This important element seems to have been known as a distinct substance before the discovery of oxygen. Cavendish, an English chemist, described it in 1778, and called it *inflammable air*. It does not appear that he really regarded it as an element, but only separated it from other inflammable gases which had been previously known, and confounded with it. Thus the light broke in upon the scientific minds of men by slow degrees. Hydrogen is abundant in nature. One ninth of the water on the globe by weight is hydrogen. Nearly all vegetable and animal substances contain it, so that whenever these substances are burned with oxygen the product of the combustion will be water. All gases, resins, tar, pitch, turpentine, fat, lard, tallow, oils, and petroleum, contain hydrogen as one of their essential elements.

Hydrogen is easily obtained in nearly a pure state. Take a pint bottle, fit a tube of lead pipe to it two feet in length, so as to pass one end of the tube under an inverted jar of water and your apparatus is complete. Now take about two or three ounces of iron turnings, or small tacks, put them in your bottle, and put in just water enough to cover the tacks, and then pour in about one third as much sulphuric acid as there was of water, and you will see the bubbles of hydrogen immediately rise and pass over into the jar. The pipe should not be placed under the jar till the air is expelled from the bottle, which will be in two or three minutes. A bladder may be used to collect the gas instead of the jar. Instead of the iron, sheet zinc may be cut into small pieces and used to better advantage; or you may granulate the zinc by pouring it into cold water.

One of the simplest and yet most beautiful illustrations of chemical affinity may be explained in the experiment of making hydrogen with zinc. Study it carefully till you comprehend it, because the same principles apply in a thousand cases. Water is a compound of oxygen and hydrogen. If now you pour on the zinc, this metal will begin to attract the oxygen of the water to itself and there will be formed a thin coating of white oxide of zinc all over every portion of the zinc. The hydrogen of the water being deserted by the oxygen, escapes in the form of a gas. Thus you see the water is decomposed into its two elements, oxygen and hydrogen. But this process is arrested, because the zinc is covered with a coating of its own oxide which prevents the water from coming in contact with the zinc. The consequence is, we get but a few bubbles of hydrogen to pass up the jar. Fortunately we have a substance that will dissolve the coat of oxide and leave a constant fresh surface of zinc. This substance is sulphuric acid. The acid unites with oxide of zinc, which is immediately dissolved in the water, and thus the oxygen of the water rapidly combines with the zinc while the hydrogen as rapidly escapes. We must speak of the properties of hydrogen in our next chapter.

SULPHATE OF IRON AS A DISINFECTANT.

In a letter to the London *Chemical News*, Mr. W. G. S. Monckford says:—"Great attention is paid, and with reason, in this country, in Holland, and in Belgium, to the disinfection of stalls and of the excrements of animals of the bovine race, infected with typhus, in order to arrest the ravages of this terribly contagious malady. The use of phosphoric acid, which is proposed for this purpose, is rational, in that it enriches the manure, but not if you consider the expense, the difficulty of transport, and the many precautions necessary in handling it. Sulphate of iron, on the contrary, is of insignificant value (say a farthing per pound), economical, and easy of employment, and, having great effect upon all animal matters, would completely purify the infected places and the manures of animals suffering from typhus. It does not injure the manure, but conserves its most energetic parts by converting the carbonate of ammonia into sulphate of ammonia, a fixed salt, which is easily appropriated by the plants. It was in 1845 that Mr. Schattermann, director of the mines of Bouxwiller, Department du Bas-Rhin, proposed the disinfection of fecal matters and of manures by means of sulphate of iron, and since then this salt has been generally employed in France for these purposes, as well as to purify the slaughter-houses, ditches, and all places where noxious emanations arise. Its use is very simple. Dissolved, it gives a very acid liquid, that can be handled without danger, and which penetrates everywhere when used to wash the infected places or to mix with the manures. When the cholera was at Marseilles, great quantities of sulphate of iron were used, not only in France, but also in Switzerland and in Germany, to disinfect closets, slaughter-houses, and all places giving off noxious emanations, and with perfectly satisfactory results. I would add that if cattle that have died from rinderpest were saturated with a solution of sulphate of iron, they might be removed with perfect safety, even in the daytime, and the cost of disinfection would be some few pence only."

A correspondent of the *Builder*, commenting on the above, says:—"From personal observation, I know that he is quite right as to the general use of this substance on the continent for disinfecting purposes; but I also know from personal experience that it really does not disinfect at all. It would

be hard to show chemically how sulphate of iron should be possessed of disinfecting properties beyond other sulphates, most of which—sulphate of lime (gypsum) included—by reason of a small amount of free sulphuric acid which they contain, act upon ammonia. On the continent, disinfection has been very imperfectly studied, whereas in this country the attention of Hoffmann and other distinguished chemists having been directed to the subject, the chemistry of disinfectants has been completely elucidated. Let Mr. Monckford turn to any of our modern standard works on general chemistry, and he will see that sulphate of iron is now not even included among true disinfecting agents."

[Dr. Voelcker, chemist to the Royal Agricultural Society of England, in a recent lecture (see this journal for April), referred to sulphate of iron as a "simple deodoriser;" while in the Memoranda issued by the Privy Council of Great Britain, in relation to cholera, it is mentioned as a disinfecting agent. "When doctors differ," &c.—Ed.]

Machinery and Manufactures.

POWER REQUIRED TO DRIVE MACHINERY.

"How many pounds of steam does it take to turn your engine over without the machinery at work?" said one engineer to another recently.

"Well I don,t know," he replied; "about ten, I suppose."

"I will wager," said the other, "you cannot pass the center with less than thirty."

He looked incredulous.

"To-morrow morning I will try it," and he did so.

He opened the throttle when the gage showed fifteen pounds and the crank was on the dead half center, but the wheels never stirred. He waited a little until the cylinder got hot; he blew the condensed water out and tried it again at twenty, but the crank never moved. At twenty-five pounds it made half a stroke but stopped on the center, and at thirty it barely turned over.

"I wouldn't have believed it," he said to himself.

This was a high pressure engine, 11 1-2 inch cylinder and 32-inch stroke, working at a boiler pressure of fifty-five and sixty pounds to the square inch. Nearly two-thirds of the pressure was absorbed in the friction of the belts, shafting, and machinery. This is not an isolated case. It is quite common, and few engineers are aware of the great loss daily incurred by simple neglect.

It is not difficult to account for it when we reflect that in many shops it is accounted of no importance if shafting is out of line, or belts laced up so tight that bearings heat; that it is of no moment whether the separate machines are in good order or not, and that one kind of oil is thought as good as another. To us it seems strange that men should be willing to pay tithes to carelessness—to waste means on nothing when money is so hard to get. It is certainly a small thing to line up shafting and to look after the other details. In the matter of oil, it is a well settled fact that the purest is the best, and that the use of cheap lubricants (so called) is a mistake. Shafting that is in line will work without any binders on the bearings, for the belts serves the same purpose, and no cap is needed except a slight cover to keep dust out.

By actual test with a dynamometer Bourne gives the following work done by an engine of 23 1-2 horse-power: Two pair of stones, 4 feet 8 inches diameter, grinding wheat; two of the same grinding oatmeal; one dressing machine; one fanner; one dust screen, and one sifter. One set runs 85 revolutions per minute, the other 90. The oatmeal stones run 120 and 140 revolutions per minute.

He also instances a cotton mill of 2.562 spindles, each making 2,200 revolutions per minute. The bobbins were $1\frac{1}{2}$ long, the thread being $2\frac{3}{16}$ long; there were also five turning lathes, three polishing lathes, two bobbin machines, two saws, one 22 inch the other 14, and 24 bobbin heads. When all the machines were off except the spindles, the actual power required was that of 21 horses, so that each horse-power drives nearly 123 spindles. A small engine of 10-inch bore and 4-feet stroke, making 35 revolutions, with steam at 90 pounds, drove two muley saws of 34-inch stroke, cutting 30 feet of yellow pine per minute, 13 inches thick.

The friction of a steam engine in good order is variously estimated at from five to eight pounds to the square inch. Of course the proper way to find out the actual figures is to take a diagram with the engine and shafting in motion, and another with the engine alone—the difference of the two showing the effective pressure. Very few persons are willing to take the trouble to do this, but go on grumbling at the high price of coal and of the waste of fuel, when they are alone to blame.

If we are to have any radical change in the waste of power in manufacture, we must begin at the details. We have spoken of this so much that we fear our readers are almost as tired of it as we are, but when we reflect upon the immense losses through simple and sheer neglect, we cannot keep silent.—*Scientific American.*

Avoiding Smoke.

The *American Artisan* remarks that:—For more than twenty years the British Parliament has debated the smoke question, and is now debating it, and will probably not let it rest until it has settled it in favour of civilization. In an article on the present discussion of it in that Parliament, *Engineering* says:—The most complete means of burning raw fuel without smoke will be found in its previous conversion into gas. We are not here speaking so much of house fire, although there is much to be said in favor of gas stoves in dwellings; but we refer more particularly to gas furnaces on the large scale for manufactories Mr. Siemens' furnaces are now used or in course of erection at all the large Bessemer-steel-works, and they are likely to be extensively adopted for many other purposes. They gasify and burn the worst rubbish answering to the designation of coal, giving a clear, intense heat without a particle of smoke. So rapidly are they coming into use in iron and steel works, glass works, enameling factories, etc., that we may, in a few years, find the old barbarous furnace-grates nearly or quite displaced by them. Mr. Siemens, although a good man of business, is more philosophical than worldly-minded; and is not one of

those who will push an invention by all lawful means. Had he hammered at the manufacturers with his improvements, there would now, no doubt, be many more of his furnaces already in use. They are costly, however, and that has proved a considerable difficulty in the way of their introduction. Mr. E. B. Wilson, according to several accounts which have reached us, has also nearly prevented the smoke from puddling furnaces by the application of a down draught, through the coal itself, the air being gradually heated as it goes down. A number of Mr. Wilson's puddling furnaces are in use at Messrs. Dawes's Milton Iron-works, not far from Barnsley, and, besides the prevention of smoke, they are represented as effecting a considerable saving of fuel.

Roper's Hot Air Engine.

This engine, founded on Ericsson's invention of using hot air instead of steam, has acquired an established reputation for its cheapness as a motive power. For several months past we have used one in our office. An engine of two-horse power will burn about ten pounds, or at present prices at the rate of five cents' worth of coal in an hour. Such a machine is equivalent to the labor of about three men. Such a machine can saw all the wood, and thresh all the grain, and shell all the corn, and grind up the coarse food in a whole neighborhood during the year. Its first cost is about $700. We see no reason why such a machine might not be introduced into many of our agricultrual communities, and be an immense saving of labor. Its use in printing offices is practised everywhere, and we see no reason why they should be specially favored above the farmer.—*Maine Farmer*

Melting Iron by Gas.

M. Schlœsing has succeeded in discovering an arrangement by which an intense heat, sufficient to melt iron, can be got from ordinary gas. The principle of his contrivance is the complete combustion of the proportionate amounts of gas and air within a confined space, and the continuous supply of the combustible materials. A copper tube carefully pierced, is the chief instrument in securing those results. M. Schlœsing was able to melt a piece of iron weighing 400. gms., in twenty minutes, by this plan.

Weakness of Large Flues.

An engineer of the English boiler insurance companies relates the following incident:—

"As an instance of the value of the hydraulic test the following is worthy of record. A large, one-flued boiler was proposed for insurance with this company, which was in course of being generally overhauled and repaired and also enlarged by the addition of several feet to its length. The old flue tube was 3 feet diameter throughout, ⅜ plates, the new part of the tube was gradually enlarged to about 3 feet 4 inches, the total length being about 38 feet. The proposed load on safety valve was 60 lbs. per square inch It was suggested to the owners to strengthen the tube by angle iron hoops or cross tubes, and their attention was directed to the fact that the calculated load (per Mr. Fairbairn's formula), under which such a flue might be expected to collapse, was little over 80 lbs. per square inch. It was also recommended to apply the hydraulic test after the alterations etc., were completed. Unfortunately the tube was not strengthened as advised, and on the test being applied, the flue collapsed almost the entire length, when the pressure had reached almost 83 lbs. per square inch, thus illustrating most forcibly the correctness of the formula referred to, and the value of the hydraulic test: as, had the boiler been set to work, the flue would in all probability have failed with fearful result."

The "Hydraulic Propeller."

A trial has recently been made of a new principle of motion, as applied to vessels, called the "Hydraulic Propeller" (Ruthven's patent). The *Nautilus*, to which the power has been applied, was built expressly to show that it can with less horse-power than ordinary river-boats equal them in speed. The *Nautilus* at the trial started from Vauxhall Bridge pier at eleven o'clock, in the morning, and ran up and down the river Thames in company with the *Citizen* and other river steamers, and held way with them steadily, gaining a little on some. She ran between Vauxhall and Westminster bridges with the wind and tide in 4′ 26″, and against in 8′ 22″, being at the rate of 13·5 and 7·2 miles per hour respectively, or at an average speed of 10·35 miles per hour—say 10¼. She then steamed down the river, and when off the Tunnel pier, with both strong wind and tide in her favor, going at full speed, was made to stop suddenly by reversing the valves. She stopped dead in less than ten seconds and in about a quarter of her length. Her Majesty's iron-clad gunboat, *Waterwitch*, now being built, is to be fitted with the new propeller, which is nothing more nor less than water taken in under her bottom and set in motion by simple machinery worked by a steam engine. The water is discharged in a heavy stream on both sides of the vessel; consequently there is nothing outside the vessel to be injured by any accident. Another important novelty is that the vessel is quite independent of her rudder, and is worked under the complete control of the master, officer of the watch, or man on deck, without any communication with the engine. The *Nautilus* is also fitted with Ruthven's steering apparatus—an invention which gives a large amount of power to the rudder.—*Mechanics' Magazine.*

A Cigar Ship at Sea.

The recent passage across the channel of the *Walter S. Winans*, a small yacht belonging to the Messrs. Winans, and of similar construction to the now famous cigar steamer *Ross Winans*, possesses much interest to the public who have watched the completion of the larger vessel, and speculated so much of her performance at sea. The steamer in question is 72 feet in length, with a diameter of nine feet, and is 24 tons register. It is propelled by a high pressure engine of 25-horse power, driving a submerged three-bladed propeller, aft, of four feet and ten inches diameter. The yacht started from Havre for Newhaven at 5.30 a.m., on the morning of the 28th of March, with seven passengers. A heavy sea was running. The yacht had on board a full supply of coal, and was immersed to a few inches below her center. The

engines worked smoothly and well, and she rode the heavy sea with ease and entire freedom from rolling. Rising slightly to the large waves she pierced their crests, which, dissolving, glided over the upper surface of her bow, and as far as the forward end of the deck; the main body of the waves passed gently along her sides, rising but little therefrom. Not a drop of water ever came upon her deck, while vessels of her size in sight were dashing the spray high over their bows. No shock of any kind was felt as she met the heaviest swells; on her rounded surface the waves could inflict no blow. The side seas, when her position was changed, and she lay in the trough of the sea, passed under without causing any perceptible roll; and this, too, whether she was going ahead or stopped. Early in the afternoon she arrived at Newhaven without accident of any kind.—*Manchester Guardian.*

A Self-Loading Ship.

M. DeCoraux, a Lyonnese, has invented and constructed a ship which can load or unload itself automatically in 40 minutes. The captain and mechanician are the only living crew on board, the working and manipulation of the vessel and cargo being all performed by steam applied to the most ingenious machinery. The loading is carried on by trucks and waggons which can contain corn, flour, bales, cattle, horses, barrels, &c. The vessel is, as may be expected, of a peculiar disposition; but its exterior bears all the signs of sea-worthiness. The great revolution is on the deck and in the interior. The former is covered with lines of rail, reaching from one extremity to the other, while at midships, there are two turntables. Front and rear are two or four immense cages, containing eight, twelve, or sixteen waggons, of the same size as our railway waggons. The rails on which the waggons rest are adapted exactly to the rails of the deck. A cable is hooked to the waggons, which traverse the deck throughout its length, and the stern of the boat having been previously placed on a level with the quay, which is also furnished with rails, or may be, perhaps, a portion of a terminus, the waggons glide without the least interruption from the vessel to the land, and *vice versa.*—*Builder.*

Tar Making in New Hampshire.

From Effingham, a.ong the northeastern shore of Ossipee Lake (or the Great Pond, as it is locally called) and stretching away toward Conway, there are thousands of acres of pine plains, the timber on some portions having been cut. It is from the roots or stumps that the tar is extracted by a company locally organized for the purpose. The largest timber of these "cut downs" has been cut long enough to have all the sap-wood rotted away, leaving nothing but the clear wood. The Rochester *Courier* says, speaking of a spot near the village of Freedom:

"Here they set their stump-pullers at work, pulling from fifty to one hundred stumps each, daily, according to the difficulties encountered. These stumps are hauled to Freedom village, where they are cut and split into pieces about the size of very fine stove wood, and placed in what is called a basket. The basket is a wrought iron cylinder, punched full of holes of about three-fourths of an inch in diameter, and holding half a cord. This basket is taken to a crane and placed in a retort made to receive it. A round top cast iron cover is then fitted on tight, with a pipe from the center, which connects with a coil of rope in a condenser.

"The gas and steam passing off from the top of the retort, and through the condenser, comes forth from a barrel in the shape of an acid (which is worth ten cents a gallon among the calico printers, but is here thrown away), and a red oil. The red oil is then passed through a still, and gives half its bulk in spirits of turpentine. The other half is thin tar, which is mixed with that which comes from the retort. From the bottom of the retort the pitch which is 'tried out,' of the pitch wood by the heat applied to it, comes forth in the shape of thick tar. There are eight or ten retorts, which bring forth forty barrels of tar a week, and seven or eight barrels of spirits of turpentine.

"A cord of pitch wood gives about three barrels of tar and eighteen gallons of spirits, besides twice that amount of acid.—*Scientific American.*

Practical Memoranda.

Pressure of the Wind.

The greatest pressure of wind ever registered at Glasgow Observatory, was 55 lb. per foot. Professor Airy, however, states that it may reach 80 lb. per foot in this country, while Mr. Scott Russell asserts that 40 lb. per foot is about the maximum force which it is necessary to reckon upon in constructing roofs, etc. This is identical with the maximum registered at Menai Bridge.—*Engineer.*

Measures and Weights.

A cubic foot of water weighs 62·5 lbs. A cubic foot of hard wood, green, 62 lbs., air-dried, 46 lbs., kiln-dried, 40 lbs. A cubic foot of soft wood, green, weighs 53 lbs., air-dried, 30 lbs., kiln-dried, 28 lbs. A cubic foot of cast-iron weighs 450 lbs.; wrought-iron, 480 lbs.; coke, 50 to 65 lbs.; coal, 75 to 95 lbs.; sandstone, 140 lbs.; granite, 180 lbs.; brickwork, 95 lbs.—*Ibid.*

Strength of Materials for Construction.

The ultimate resistance in pounds per square inch of section of various materials for construction are as below:—

Name of the material.	*Resistence to extension.*	*Resistence to compr'n.*	*Tensile str. in practice.*	*Comp. stg. in practice.*
White pine	10,000	6,000	2,000	1,200
White oak	15,000	7 500	3,000	1,500
Rock elm	16,000	8,011	3,200	1,602
Wrought-iron	60.000	50,000	12,000	10,000
Cast-iron	20.000	100,000	4,000	20,000

In practice, the fifth part of the above strengths is all that should be employed, as given in the third and fourth columns. The dimensions of pieces of wood or iron, however, used to resist compression, are often determined more with regard to the power of the piece to resist bending or bulging than to resist crushing, as in posts.—*American Artisan.*

Polished Steel.

Polished surfaces of steel and iron may be prevented from rusting by exposure to water if they are coated over with a mixture of lime and oil.

Water-Power.

It has been estimated that a ton and a-half of water falling one foot per minute, will grind and dress a bushel of wheat per hour.

Load Strain on Bridges.

Professor Rankin has shown that the strain thrown on a bridge by a load moving at an infinite speed is precisely double that produced by the same load when at rest, consequently moving loads, such as railway trains, strain a bridge more than static loads in some determinate ratio to the speed.

Comparative Magnitude of the Planets.

The comparative magnitude of the planets is as follows:—Supposing the earth to be 12 inches in diameter, then Herschell is 4 feet 5 inches, Saturn 10 feet, Jupiter 11 feet 3 inches, Venus 11¾ inches, Mars 6½ inches, Mercury 4¾ inches, Pallas 3¼ inches, Juno 2¼ inches, Ceres 1½ inches, and Vesta only ⅓ inch. The sun is 111 feet 8 inches, and the moon 3¼ inches.

Absorption of Radient Heat.

Dr. Tindall states that the absorption of radient heat by atmospheric air in a short tube, and at a tension of 30 inches, being taken as 1, chlorine would be 36; hydrochloric acid, 62; carbonic acid, 90; sulphureted hydrogen, 390; olefiant gas, 970; ammonia, 1,195.

Electro-Magnetic vs. Cornish Engine.

One grain of zinc was found to raise only 8 lbs. 1 ft. high by means of an electro-magnetic engine; one grain of coal in the furnace of a Cornish engine will raise 143 lbs. through the same distance.

Statistical.

CANADA AND THE UNITED STATES.

Comparative Rates of Progress.

The population of the United States has progressed as follows:

1800	5,305,925
1810	7,239,815
1820	9,638,121
1830	12,866,020
1840	17,069,453
1850	23,191,876
1860	31,429,891

"There is nothing in the old world to equal this rate of progress" says Sir Morton Peto in his work upon the "Resources and Prospects of America." True—not in the old world; but in another new world there has been a progress which exceeds it. From 1851 to 1861 the population of Canada increased more rapidly than that of the United States. Canada increased in the ten years 36 per cent. We do not notice that this fact is mentioned in Sir Morton's book, but fact it is, and perhaps when he turns his able pen to writing an account of the Resources and Prospects of Canada, he will dwell upon it as much as he has upon the progress of the population of the United States. Our object in directing his and others' attention to it is that there may be no misconception in the matter, for any one taking up Sir Morton's work and reading "there is nothing in the old world to equal this rate of progress," may run away with the notion that America has outstripped every other country in population increase, whereas the fact is she has in late years not equalled the progress in this respect of her young and vigorous neighbour, Canada.

We do not dispute Sir Morton's statement that the progress in population of the United States has far exceeded that of other countries of the old world; we only desire to supplement it by another fact, that Canada has progressed even more rapidly than America.

Canada has increased more than the other provinces in population, but the rate of increase of all the provinces nearly equalled that of the United States.

How will it be in future? Two-thirds (21,000,000) of the population of America are said to be derived from emigration from this and other old countries. Canada, too, no doubt greatly swells her population by the same means. If it be true, as stated in our last (page 428) that the taxation in America is now as high as £2 5s. 8d. per head against 7s. 6d. in Canada, will not this fact influence the tide of emigration, carrying it more into Canada than America?

America is naturally a very rich country, but the abrogation of the reciprocity treaty with Canada, from which she used to obtain cheaply and conveniently under that treaty many valuable articles in a raw state for manufacture and use in America; the high rate of taxation; and the strange and infatuated adoption of the old exploded narrow minded principles of protection, are so many drawbacks to American progress, while Canada appears to be better off than ever in government and other circumstances favoring prosperity.—*Herapath's Journal.*

The British Estimates for 1860.

The civil service, army, and navy estimates for the coming year, now before the British Parliament, amount to £32,483,153, or $162,415,765, divided as follows:—Civil service, £8,000,000; army, £14,095,000; navy, £10,388,152. Some of the items of these accounts are interesting.

The palaces cost £49,000, and £99,000 more go for the adornment of the royal parks. Fifty thousand pounds are set apart for the erection of a building to contain the natural history collections of the British Museum, and a similar amount for the purchase of a site for the enlargement of the National Gallery. The "Poor Law Commissions" of England, Ireland, and Scotland entail an additional expense of £242,000; and the "Secret Service demands £32,000. Printing and stationary cost £357,000, and the postage of letters on the public service in the departments is £138,000. Education costs £1,300,000, and the number of

scholars is estimated at a million. The Colonial rulers receive £100,000, and nearly £50,000 go for the support and conveyance of captured negroes and liberated Africans, and the salaries of the Mixed Commission established under treaties with foreign powers for suppressing the traffic in slaves, besides the expense incurred in maintaining ships for this purpose.

The army consists of 138,117 men of all ranks, divided as follows:—Regiments, 128,212; depots in the United Kingdom of regiments in India, 8,983; general staff, 93; establishments, 548; educational do., 281. Of the total, 7,150 are officers; 13,454 non-commissioned officers, and 117,513 rank and file. The military service in Canada costs £608,000; in Nova Scotia, £193,000.

The navy comprises 765 vessels of all classes, of which only 93 are in commission, carrying 3,936 guns. Sixteen ships carry from 70 to 104 guns each; and the iron-clad fleet numbers eleven vessels, carrying 216 guns. Twenty-eight war vessels are building; one of which is an iron-clad. Both the aggregate of naval vessels and of commissioned ships is less than those of last year.

The British navy costs more than the American, according to the respective estimates for the year 1866–7. The former is kept up at a cost of $50,000,000; the latter for $43,000,000.

U. S. Rebellion Casualties.

The hospital records show the enormous aggregate of 253,000 Union soldiers to have died on battle-fields and in hospitals during the war, to suppress the Rebellion. This does not include those who died at their homes of lingering disease contracted in the service.

Crimean Projectiles.

Official Records show the following as the number of projectiles used by the opposing armies and naval forces: French, 29,460,353; English, 15,000,000; Piedmontese, 50,000; Turks, 50,000; Naval Forces (Allied), 35,000; Russian, 45,000,000. Total, 89,595,363.

Killed and wounded by these projectiles: French, 50,836; English, 91,038; Piedmontese, 183; Turks, 1,000; Naval Forces (Allied) 2,000; Russian, 100-000. Total, 175,057. Only one projectile in 512 did any execution.

Galleries of the Louvre.

The Paris *Moniteur des Arts* gives the following Art statistics:—The galleries of the Louvre, exclusive of the Campana collection, contain nearly 2,000 pictures, viz: 560 Italian, 620 Flemish, Dutch and German, 700 French, and 20 Spanish. There are 12 Raphaels, 3 Corregios, 18 Titians, 13 Paul Veroneses, 9 Leonardo de Vincis, 5 Perugins, 4 Giorginis, 42 Rubenses, 22 Van Dycks, 17 Rembrandts, 18 Wouvermans, 54 Teniers, 2 Hobbemas, 11 Bergheims, 10 Van Huysums, 10 Holbeins, 11 Murillos, 42 Poussins, 24 Lesueurs, 16 Claude Lorraines, 4 Joseph Vernets, 13 Davids, 7 Girards, and 3 Gros.

Consumption of Coal in Great Britain.

The consumption of coal, including waste, in the United Kingdom, amounts to three times the quantity expended in 1845. In the year 1845 the consumption in Great Britain, for domestic and all manufacturing purposes, was 31,800,000 tons, and there were exported in the same year, 1,800,000 tons. In 1865, however, there were consumed for domestic and all purposes of manufacture 87,000,-000 tons, 9,000,000 tons being exported.

Cincinnatti Bridge.

The great Cincinnati Bridge about to be suspended across the Ohio River will be the longest in the world, being over 2,000 feet longer than the Suspension Bridge over the Niagara River, and 540 feet longer than the Menai Bridge in England. Its total span will be 1,057 yards. The massive stone piers tower 110 feet over the floor of the bridge, and 200 feet above their foundations. One year is the period allowed for building it.

Miscellaneous.

Pitch Lake of Trinidad.

A Trinidad correspondent of the *Trade Review* gives the following description of the celebrated Pitch Lake in that island:—

"This wonderful and singular natural formation is situated at a place called La Brea, and is about sixteen or twenty miles from Port-au-Spain, the capital of the island. Its area is between one hundred and two hundred acres,—that is the lake itself—but the same formation extends down to the sea shore, and even for some distance under the sea. The substance itself is a hard, black, shiny pitch—this is the appearance of that along the road to the lake, (which is about a mile from the shore) but that found in the lake—in some parts of it—is quite soft and almost liquid. But the most singular thing about this lake is, that all attempts hitherto made to find out the depth of this formation, have been futile, and that, too, from natural causes which I will explain. The men engaged in mining the pitch, work on the surface of the lake, which is comparatively hard, (except in some places, where, as I have already said, it is soft and liquid), with pick axes and spades, chopping out the solid pitch in good sized pieces; but the elasticity and expansibility of this substance is so great, that even when they have dug a pit, say to the depth of four or five feet, and perhaps six feet long, by five feet wide, in the course of a day, they will find on returning to their work in the morning, the walls of this hole approximating so closely as to be almost touching each other, and if left for four or five hours longer there is not to be seen the slighest trace of where the night before was a yawning pit in the surface, and thus no sensible diminution is visible in the quantity existing in the lake, even with the large amount annually removed, for shipment to foreign ports. Very considerable quantities of this pitch are annually exported to England, in vessels chartered for that purpose, from which oil is refined. It is also used for the ordinary purposes of gravel roofing. Of course the theories as to the cause of this singular formation, are various, but the most sensible one is that it is of the same nature as the

gum regions, produced probably by the solidifying of the exudations of oil; and that it undoubtedly overlies vast quantities of oil, which some day, if developed, will prove Trinidad to contain a richer and more inexhaustible oil treasure, than has yet been discovered in the known world. We understand that an American company who have purchasd some land near the lake, are preparing to bore for oil; but, from the difficulty experienced in transporting machinery, and securing labourers who understand the business, their efforts as yet have not resulted very favourably, but they are sanguine of success, and doubtless before many months, we will hear of their having made a great strike."

Ozone and Cholera.

Dr. Scheil says: "Ozone is oxygen in a highly electro-negative condition, and air or oxygen ozonized by means of electricity, phosphorus, light, or any other method, may be combined with non-ozonized air or oxygen to form a galvanic circuit."

In support of the above theory, A. T. Hay, in the *Scientific American*, says:—I will present a few facts that have come under my own observation.

In dry, sultry weather, when there is the least amount of ozone present in the atmosphere, telegraph lines are frequently interrupted by the current coming in contact with non-ozonized oxygen, which forms independent or contra-galvanic circuits on the wire, rendering the transmission of messages very difficult or impossible for the time being. A thunder storm at such times always has the effect of destroying such contra circuits. Telegraph lines always work more or less imperfectly in hot weather, and particularly so where the lines are built parallel with large rivers on the low ground, where the least amount of ozone is present.

Ozone is destructive to malaria, and highly beneficial to health in times of cholera or other malarial epidemics.

In telegraph offices there is always the maximum amount of ozone, or highly electro-negative oxygen combining with the non-ozonized oxygen, and thereby rendering the atmosphere pure. During the prevalence of cholera in this country from 1849 to 1854, inclusive, I was connected with the telegraph lines in the States west of the Ohio river, and during that whole time I never knew an instance of a telegraph operator dying of, or even being attacked with, cholera; and in those days telegraph offices in the river towns were generally located in low grounds where cholera prevailed to the most alarming extent.

Foul Atmosphere of Court Houses.

At a recent meeting of the Manchester Literary and Philosophical Society, a paper was read by the President, R. Angus Smith, Ph. D., F. R. S., etc., "On air from off the Atlantic, and from some London Law Courts," The specimens of air collected by Mr. Fryer, when on his way to the West Indies, and those collected in Antigua, are worth remarking, as the first agrees with the figures obtained previously when examining air on the shore and open heaths of Scotland, where the highest average was obtained, and the second agrees with the numbers obtained in more inhabited but not closely inhabited places. Those from a law court are interesting; they are the most deficient in oxygen of any specimens found by me during the day in inhabited places above ground. The first is almost exactly the same as the average found in the currents of galleries in metalliferous mines; that from the lantern is nearly the same as the specimens found close to the shafts of the same mines, meaning of course the average of many specimens. I have not known any mills or workshops so deficient in air. I consider a room bad when it loses 1,000, and workshops very bad when they lose 2,000 of oxygen out of a million parts; here the loss is actually 5,000 less than the parks of London. The circumstance is strange and I hope unusual. A scientific friend happened to call my attention to it and wished me to examine the air. The moisture from the window was collected and there were several ounces obtained, and more might have been easily found. It was perspiration in great part, the smell of it was distinct. It is putrefying, and decolorizes more permanganate now than it did first.

Mere change of air will not purify a room like this—a current must pass through it for a long time until complete oxidation takes place.

Clean the Cellars.

We advise farmers and others to be particular and thorough in cleaning their cellars, sinks, &c., and in removing all filth and rubbish from the vicinity of their dwellings. We advise it as a cholera preventive, and, likewise, as a precaution against the approach of various forms of sickness to which we are particularly liable in the summer season. Do not wait until hot weather comes, and the smell of decayed vegetables in the cellar, render the work a necessity, but purify your premises now.

Soon as danger from the freezing is over, all vegetables keep better if removed to an upper room where the air is dryer. After removing such from the cellar, and cleaning away the *debris*, it is well to scrape off a little of the bottom, if it be of dirt, and take it away, and then scatter some quick lime, or other disinfectant, in various places. Don't neglect to whitewash the walls and ceiling overhead. Then give the cellar a free airing when the weather is warm and dry. Provide, also, for a free circulation of air throughout the entire season. We believe that farmers' cellars can often justly be charged with producing much sickness, and the proper cleansing of them is a matter that cannot be safely neglected, during the coming season. Clean up the yards also, and be watchful that there is no decayed vegetable matter in proximity to the dwelling.—*Rural New Yorker.*

Liebeg on Ventilation.

Liebeg suggests that in close rooms, and on shipboard, deficient ventilation may be compensated for by the use of hydrate of lime. Eighteen or twenty pounds of slaked lime will absorb 38 or 39 cubic feet of carbonic acid gas, which would be immediately replaced by an equal volume of fresh air entering through the crevices.

DIFFERENT sounds travel with different degrees of velocity. A call to dinner will run over a ten-acre lot in a minute and a half; while a summons to work will take from five to ten minutes.