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CANADIAN MINING.

Local papers in various parts of the province have given, during the past year, descriptive accounts of the discovery of mineral veins, containing respectively copper, argentiferous galena, antimony, and even gold. There can no longer be any doubt, that large and valuable deposits of one or all of these minerals, have recently been brought to light, either in the vein rock or in the drift. In another part of this number, a description is given of gold mining in Lower Canada, and we now propose to make a few remarks on the lead ores and especially those which are reported to contain silver. A general knowledge of the distribution of argentiferous lead ores, will be valuable at the present time, as many persons who have discovered lead veins, are under the impression that they are necessarily argentiferous, and consequently possess a high value.

Lead ores occur in both the chrystalline or fossiliferous and in the unchrystalline or metamorphic rocks, those which being once fossiliferous, have been altered or changed by heat or some other metamorphic action.

Lead is found in the largest quantities in those rocks which have not been altered or rendered chrystalline by metamorphic action. The great lead-mining districts of Spain and the United States are in lower silurian rocks. The celebrated galena limestone of Wisconsin, Iowa, and Indiana, is of the same age as the Trenton limestone of Canada, a formation which occupies a large portion of the western province, extending from Kingston to Matchedash Bay on Lake Huron, and bounded on the south by Lake Ontario east of Port Hope. The Trenton limestone is also found on the Ottawa, and it is near its junction with the Laurentian Gneiss, at its northern boundary, that lead veins have been found in various localities. The great lead bearing rocks of the north of England, are found in the mountain limestone; a formation not represented in western Canada. Spain, the United States, and England, furnish nearly 70 per cent. of the whole amount of this metal raised in the world.

Lead is also found in metamorphic rocks, and it is well worthy of note, that in these older chrystalline rocks, the galena or lead ore, is generally argentiferous, and sometimes contains very considerable quantities of that metal. The fossiliferous or unaltered strata, are not so argentiferous, and do not generally contain enough silver to render the search for that metal commercially profitable, although where the best metallurgic arts are employed, as in England and Germany, as small a quantity as seven or eight ounces to the ton, are profitably obtained. This is about ·003 per cent. As a general rule, the older and more chrystalline the formation, the larger the amount of silver will be found in the ore. So that following this rule, we may expect to find the lead ores from the highly chrystalline rocks of Lake Superior, more argentiferous than those from the unchrystalized Trenton limestone. In New Hampshire, mines of argentiferous galena, have been long worked with indifferent success. The ore contains from 60 to 70 ounces of silver to the ton of 2,000 lbs. of lead.

It is well worthy of note that the lead ores of the vast deposits of Wisconsin, are almost destitute of silver. From numerous analyses that have been made, they are found to yield from ⅛ of an ounce to 9½ ounces of silver to the ton of 2,000 lbs. of ore. The highest of these values would not render them profitable as a source of silver in this country, where machinery is expensive and labour dear.

The lead ores of Cornwall, average about 23 ounces to the ton, they are contained in chrystalline rocks—those of Derbyshire yield only one or two ounces to the ton; these ores are from the unchrystalline rocks.

The lead ores of Missouri yield only ·001 or ·002 per cent. of silver, or less than one ounce to the ton, even in the most argentiferous specimens.

In 1858, the total value of the silver obtained from the lead ores of the United Kingdom, amounted to £142,336 sterling; the value of the silver bullion imported, amounted in 1857, to £397,441.

The following localities where lead ore is found in Canada, are enumerated in the Descriptive Catalogue of Canadian Minerals: (Sir W. F. Logan.)

1. Gaspé—Indian Cove—found in the Lower Helderberg Group, Upper Silurian.
2. Upton—Quebec Group, Lower Silurian.
3. Ramsay Mines—Calciferous Formation, Lower Silurian.
4. Landsdowne—Laurentian.
5. Bedford—Calciferous Formation, Lower Silurian.

From the foregoing statements it will be seen that argentiferous galena, susceptible of being profitably worked, is of comparatively rare occurrence in those fossiliferous rocks which have not been metamorphosed or rendered chrystalline, and persons cannot be too cautious in accepting statements relative to the richness of lead ore or silver, until a proper analysis has been made from specimens which represent the general characters of the vein or metalliferous deposit.

HEAT & MOTION.—A NEW PHILOSOPHY.*

How frequently does it happen that two men thinking and acting, independently of one another, arrive at similar results by very different means. Who does not remember the history of the planet Neptune, and the almost simultaneous prediction of its existence by the English mathematician, Adams, and the French astronomer Leverrier? In 1845 Adams computed the place of this planet within two degrees, and placed the manuscript containing his calculations in the hands of the Astronomer royal, in whose possession they remained, almost unnoticed, until 1846, when Leverrier announced that a planet ought to be found in a particular part of the heavens, where, to the astonishment of the world, it was actually discovered by M. Galle on the 23rd Sept. of the same year. So also with the planet Vulcan; a village doctor humbly pursuing celestial observations, with the grand idea constantly in his mind that he should sooner or later discover a planet between Mercury and the sun, saw a dark spot across the disc of the great luminary, and at once knew that he had seen what his previous calculations told him ought to exist. Meanwhile Leverrier, observing the perturbations in the motion of the planet Mercury, arrived at the conclusion that there must be another unobserved body between Mercury and the Sun. He declared his conviction to the Academy of Science, and in due course the village doctor, Lescarbault, at Orgéres, tremblingly wrote to the Imperial Astronomer that he had seen the planet whose existence the great mathematician had predicted.

As in the sublime science of Astronomy, so also in the not less beautiful field of experimental research, two men, living far apart and totally unknown to one another, conceived and worked out the same idea by totally different methods. Dr. Mayer, of Heilbron, in Germany, enunciated the exact relation which exists between heat and work or mechanical force, in the spring of 1842. He arrived at his results by reasoning on certain observed effects. In 1843 Mr. Joule communicated a paper to the British Association, in which he described a series of experiments on magneto-electricity, executed with a view to determine the mechanical equivalent of heat. He found that to raise one pound of water one degree of Fahrenheit's thermometer, as much heat was required as would raise seven hundred and seventy-two pounds weight, acting mechanically, one foot high. Dr. Mayer, in 1842, determined, by calculation, the mechanical equivalent of heat to be 771·4 foot pounds, differing only from Mr. Joule's determination by $\frac{1}{16}$ of a pound in 772 pounds. We shall explain further on what is meant by foot pounds, and the expression "mechanical equivalent of heat."

In the series of lectures delivered by Professor Tyndall before the Royal Institution last year,* the rudiments of a "New Philosophy" have been brought within the reach of any person possessing ordinary intelligence and culture, who takes the trouble to think about what he is reading and observing.

Heat has always been a great mystery. Men have puzzled their brains for generations about its origin, its entity, its relations, its effects and its finality. The achievements of heat through the steam engine are known wherever steam has been made the agent of motive power. But motive power implies mechanical force, and every child finds that by rubbing his hands sharply together he produces heat; hence some common quality must unite this agent, heat, with the ordinary forms of mechanical power. Heat and mechanical force then, are very intimately connected, in fact, one cannot exist without developing in some form or other its inevitable companion.

Let us examine this relationship, and endeavour to state in popular phraseology what is now known of heat, and its invariable associate mechanical force.

As an illustration of the practical results of the conversion of heat into mechanical force, the following may be instanced:—a pound of coal placed under the boiler of the best steam engine now constructed produces an effect equal to raising a weight of one million pounds a foot high. But the mechanical energy resident in one pound of coal and liberated during its combustion, is capable of raising to the same height ten times that weight; nine-tenths at least of its mechanical power being lost in overcoming friction and other imperfections of even the best steam engines.

Accurate experiment implies the use of accurate and sensitive instruments. The common thermometer, however delicately constructed, is far too sluggish and inert a piece of mechanism to subserve the purpose of the modern inquirer into the secrets of the "New Philosophy."

* This article by the Editor was published in the December number of the *British American Magazine*.

* Heat considered as a mode of Motion. By John Tyndall, F.R.S.

The thermo-electric pile* possesses the requisite delicacy for indicating minute and rapid changes of temperature. Breathing for an instant on such an instrument, causes the needle of the attached galvanometer to be powerfully deflected in one direction; touching it for an instant with ice produces a prompt and energetic deflection in the opposite direction. Hence the thermo-electric pile is capable of indicating instantaneously, not only heat and cold, but their minutest variations.

As a general rule, whenever motion is arrested heat is produced, and *vice versa*, and the heat evolved in the measure of the force expended. It is a pretty and instructive experiment to fill a brass tube with water nearly to the brim, insert a cork tightly, and cause the tube to involve rapidly by means of a common whirling table. With a pair of wooden tongs the brass tube may be gently squeezed so as to produce friction, and thus generate heat by converting mechanical force into that agent. The water will soon boil, and in two minutes and a half the cork may be violently projected by the steam, with a report like that of a pistol. Opposite effects produced in an apparently similar manner can be beautifully explained by the "New Philosophy." Air expelled from a bellows strikes the face of the thermo-electric pile, and the vibrating needle shows instantly that heat is generated by the destruction of the motion. But the carbonic acid of a bottle of soda water driving out the cork produces cold when it strikes the face of the pile; the gas was compressed in the bottle, it performed mechanical work as it drove out the cork, and it consumed just as much heat as it performed work.

The dynamical or mechanical theory of heat discards the idea of materiality. The supporters of this theory do not believe heat to be matter, but a condition of matter, namely, a *motion* of its ultimate particles. When a sledge hammer strikes a piece of iron or lead, its descending motion is arrested and is transferred to the atoms of the lead or iron, and announces itself to our nerves as heat. Mr. Joule in his experiments agitated water, mercury, and sperm oil, in suitable vessels, and determined the amount of heat generated by the motion and labour or mechanical force expended in the operation. He varied his experiments in many different ways. He caused disks of iron to rub against one another, and measured the heat produced by their friction, and the force expended in overcoming it. The results at which he arrived leave no shadow of doubt upon the mind that, *under all circumstances, the quantity of heat generated by the same amount of force is fixed and invariable.* Turning to natural forces, we arrive at many important and unexpected conclusions of singular interest. The flow of rivers generate heat by the friction of the water against the bottom; the sea becomes warmer after a storm, by the clashing of the waves against one another, and the conversion of the mechanical force they exert into heat. May we not explain the sudden disappearance of the ice from our bays and lakes in the spring of the year, after a storm, in this manner? The extreme cold of the petroleum which issued from some of the spouting wells in Enniskillen may be explained in the same way as the cold produced by the exit of the gas from a bottle of soda water. No doubt at the depth of two hundred feet the petroleum is warmer than the mean temperature of the air above; but the vast mechanical force of compression employed in projecting it some thirty feet above the ground in a continuous stream is sustained by heat, and in accomodating itself to the new condition of pressure, its own heat is converted into mechanical force, and its temperature becomes much reduced. As the result of Mr. Joule's experiments, it was found that the quantity of heat which would raise one pound of water one degree of Fahrenheit in temperature, is exactly equal to what would be generated if a pound weight, after falling through a height of 772 feet, had its moving force destroyed by collision with the earth. Conversely, the amount of heat necessary to raise a pound of water one degree in temperature, would, if applied mechanically, be competent to raise a pound weight 772 feet high, or it would raise 772 pounds one foot high. The term "foot-pound" has been introduced to express the lifting of one pound to the height of one foot. And the quantity of heat necessary to raise the temperature of a pound of water one degree, being taken as the standard of measurement, 772 foot-pounds constitute what is termed the "*mechanical equivalent of heat.*"

Among the illustrations showing the conversion of mechanical force into heat, the following may be specified: A rifle bullet, when it strikes a target is intensely heated. Cannon balls striking the plates of an iron-clad produce a flash of light and

* The thermo-electric pile consists of a number of bars of antimony and bismuth, soldered together at alternate extremities When a hot body is applied to the points of junction a current of electricity is generated, the direction of the current being from the bismuth to the antimony. When a cold body is placed in contact with the points of contact with the points of junction, a current is generated in the opposite direction, or from the antimony to the bismuth. The existence and direction of the current are shown by its action on a freely suspended magnetic needle. Such an instrument is termed a galvanometer, and when the effect of the current is multiplied by passing it through a coil of wire, and the needle rendered independent of the magnetic force of the earth by a second needle placed above it, with reversed poles, the galvanometer becomes extremely sensible to variations of temperature, and indicates "heat" or "cold" by moving to the right hand or the left hand, according to the direction of the current.

become hot. The simple stoppage of the earth in its orbit would develope heat equal to that derived from the combustion of fourteen globes of coal, each equal to the earth in magnitude; and if after this stoppage of its motion, which would be abundantly sufficient to reduce it in great part to vapour, it should fall into the sun, as it assuredly would, the amount of heat generated by the concussion would be equal to that developed by the combustion of 5,600 worlds of solid carbon. Motion arrested is the same as mechanical force arrested, and having ascertained with precision the exact amount of heat generated by the stoppage of the motion of one pound of matter of known speed, it becomes a simple arithmetical calculation to find out the amount of heat produced by the sudden arrest of the motion of any body whose speed and mass are known. Turning from the amazing magnitude of the results which present themselves to our strained imagination, where the earth and sun form the basis of calculation, let us examine the nature of the forces called into action when atoms clash together, as during combustion:—

"It is to the clashing together of the oxygen of the air and the constituents of our gas and candles that the light and heat of our flames are due. I scatter steel filings in this flame, and you see the star-like scintillation produced by the combustion of the steel. Here the steel is first heated till the attraction between it and the oxygen becomes sufficiently strong to cause them to combine, and these rocket-like flashes are the result of the collision. It is this impact of the atoms of oxygen against the atoms of sulphur which produces the flame observed when sulphur is burned in oxygen or air; to the collision of the same atoms against phosphorus are due the intense heat and dazzling light which result from the combustion of phosphorus in oxygen gas. It is the collision of chlorine and antimony which produces light and heat observed when these bodies are mixed together; and it is the clashing of sulphur and copper which causes the incandescence of the mass when these substances are heated together in a Florence flask. In short, all cases of combustion are to be ascribed to the collision of atoms which have been urged together by their mutual attractions."*

Nature is full of anomalies which no foresight can predict, and which experiment alone can reveal. From the deportment of a vast number of bodies, we should be led to conclude that heat always produces expansion, and that cold produces contraction. But water is an exception to this rule, and a most important one; so is bismuth. If a metal be compressed heat is developed; but if a metal wire be stretched cold is developed. If a piece of India rubber be stretched heat is developed; and again, if a piece of India rubber be heated it will be shortened. Wax passing from the solid to the liquid state expands, and the melting point of some substances which contract on solidifying has been raised by pressure as much as 20° and 30° Fahr., thus establishing the fact that the melting point of many bodies is dependent upon the pressure to which they are subjected—a discovery which has an important bearing upon the thickness of the crust of the globe.

* "Heat considered as a Mode of Motion." By John Tyndall, F.R.S., &c.

The comparatively tranquil boiling of water is dependent upon the air it contains; if pure ice, which contains no air or any foreign matter, be melted under spirit of turpentine, so as to exclude all air, it can be heated far beyond its boiling point, and when ebullition does take place, it occurs with explosive violence. It is probable that the explosion of locomotives, on quitting the shed where they have remained quiescent, just as the engineer turned on the steam, may have arisen from the water being deprived of air by long boiling, and the mechanical act of turning on the steam and thus diminishing the pressure on the water, may have caused the rupture of cohesion between the particles of water and the sudden formation of a large quantity of steam of explosive force.

When the temperature of any body, such as lead, is raised, what becomes of the heat? Here is an important question which the "New Philosophy" is competent to solve—discarding altogether the old notion of latent heat, or the destruction or loss of heat. Nothing is lost in nature, if a force disappear we may be sure to find it again in another form or doing *interior* and invisible *work*.

Suppose that heat is communicated to a lump of lead, how is that heat disposed of within the substance? It performs two different kinds of work. One portion imparts that species of motion which raises the temperature of the lead and is sensible to the thermometer. The other portion goes to force the atoms of lead into new positions so as to destroy the cohesion between the particles of lead, it melts, and we observe the effects produced. When the body cools, the forces which were overcome in the process of heating come into play, and this heat which was consumed by the forcing asunder of the atoms is now restored by the drawing together of the atoms.*

The energy of the forces engaged in this atomic motion and interior work, as measured by any ordinary mechanical standard, is enormous. A

* Tyndall's Lectures, page 155.

pound of iron, on being heated from 32° to 212° F., expands by about $\frac{1}{800}$th of the volume it had at 32°. But it expands with almost irresistible force, and the amount of heat required to effect the expansion would raise eight tons one foot high. Water expands on both sides of its point of maximum density, namely, 39° F. Suppose it to be heated from 38 F. to 40 F. (more accurately from 3½ C. to 4½ C.) its volume at both temperatures is the same; still, an amount of heat has been imparted to the water sufficient to raise 1390 lbs. one foot high. The interior work done in this case by the heat, can be nothing more than turning round the atoms of water, preparing them as it were to assume the form of steam, as opposed to the condition in which they were ready to assume the form of ice, before the additional heat was imparted to them. Owing to the high specific heat of winter, a pound of that fluid in losing 1° of temperature, would warm 4 lbs. of water 1°. But water being 770 times heavier than air, it follows that when equal volumes are compared, a cubic foot of water in losing 1° of temperature would raise 3080 cubic feet of air 1°. Hence we see what an extraordinary influence the great lakes must exercise upon the climate of Canada, and especially upon the winter temperature of their shores. The warmth of the Niagara district is explained by this fact. The heat of summer is stored up in lakes Erie and Ontario, and slowly given out during winter On the lake shore snow does not lie nearly so long as a few miles inland.

The force of gravity sinks into insignificance when compared with molecular forces. When the atoms of oxygen and hydrogen clash together to form an atom of water, the force they exercise is positively enormous. A pound of hydrogen combining with 8 lbs. of oxygen to form 9 lbs. of water clash together with a force equal in mechanical value to the raising of forty-seven million pounds one foot high. When the molecules of 9 lbs. of steam fall together to form 9 lbs. of water the force of condensation is equivalent to raising 6,718,716 lbs. one foot high. Finally, when 9 lbs. of water pass from the liquid state to that of ice, the mechanical value of the act is equal to 993,564 foot-pounds. These results tabulated are as follows:—

	Equivalent of Mechanical force expressed in lbs. raised one foot high.
1 lb. Hydrogen, 8 lbs. Oxygen } 9 lbs water....	47,000,000
9 lbs. steam condensed to water..	6,718,716
9 lbs. water assuming the form of ice	993,564

Or, in other words, the first effect is equal to a fall of a ton weight down a precipice 22,320 feet high, the second down a precipice 2,900 feet high, and the third the descent of a ton down a precipice 433 feet high. The curious reader will observe a close relationship between the cube roots of these numbers, which are 28·15556; 14·26400; 7·365355.

The condensation of heat in organic bodies possesses some important peculiarities of especial interest to the vegetable physiologist. There are in wood three lines, at right angles with each other, which the mere inspection of the substance enables us to fix upon as the necessary resultants of the molecular action; the first line is parallel to the fibre; the second is perpendicular to the fibre and parallel or tangential to the ligneous layers, which indicate the annual growth of the tree; while the third is perpendicular to the fibre and to the ligneous layers. These three lines are axes of unequal calorific conduction, and the conducting powers are in the order of the lines above named. In virtue of this property a tree is able to resist sudden changes of temperature, and sudden obstruction of heat from within and the sudden accession of it from without. But Nature has gone farther, and clothes the tree with a sheathing of bark, of worse conducting material than the wood itself.

The relation between light and heat is most interesting, especially in the manner in which these agents affect our nerves. The discovery of invisible rays of light opened a wide field for speculation, so also has the discovery of inaudible waves of sound. Some animals and insects may possess the curious faculty of seeing by what are the invisible rays of light to us, and of hearing by what are the inaudible waves of sound.

Insects may communicate with one another by means of sounds which lie beyond the range embraced by our organs, just as bats and night-feeding birds may see by light which to us is invisible.

The properties of gasses with respect to radiant heat are most astonishing. Air scarcely absorbs any sensible quantity of radiant heat, but if air absorbs one ray, ammonia will absorb 1195 rays, and olefiant gas 970. Hence, although ammonia is as transparent to light as the air we breathe, it is almost opaque to heat. But if the absorbtion be estimated at a low tension, that is to say when a small quantity of gas only is present, the difference becomes more apparent and striking. Thus at a tension of one inch, for every individual ray struck down by the air, oxygen, hydrogen, or nitrogen—ammonia strikes down a brigade of heat rays 7,260 strong—olefiant gas a brigade of 7,950, while sulphurous acid destroys 8,800 rays. This property is most important in its bearings upon climate. Aqueous vapour, which always exists in the air, absorbs heat with great vigour. Regarding the earth as a source of heat, at least 10 per cent. of its heat is intercepted within ten feet of the surface by the aqueous vapour of the air. The removal, for a single summer night, of the aqueous vapour from the atmosphere which covers England, would be attended by the destruction of every plant which a freezing temperature would kill. The moisture of the air covers the earth as with a blanket at night, and where the air is dry as in the great desert of Sahara and the plains of Thibet, or the deserts of Australia, ice is frequently formed at night by the direct radiation of the heat of the earth towards the planetary spaces; there being no blanket of aqueous vapour to retain it. So powerful is the effect of aqueous vapour in retaining heat, that although the atmosphere contains but one particle of aqueous vapour to 200 of air on an average, yet that single particle absorbed 80 times as much heat as the 200 particles of air. The obscure heat of the moon is absorbed by the aqueous vapour of the atmosphere, so that, little or none can reach the solid earth directly, while the heat of the sun's rays is so great, that when vertical they are competent to melt nearly half an inch thickness of ice per hour, and the total amount of solar heat received by the earth in a year, would, if distributed uniformly over the earth's surface, be sufficient to liquify a layer of ice 100 feet thick and covering the whole earth, and yet the quantity of solar heat intercepted by the earth is only $\frac{1}{2300000000}$ of the total solar radiation. The heat of the sun if used to melt a stratum of ice applied to the surface of that glorious luminary, would liquify it at the rate of 24,000 feet an hour, and it would boil, per hour, 700,000,000,000 cubic miles of ice-cold water. Expressed in another form, the heat emitted in a year, is equal to that which would be produced by the combustion of a layer of coal, 17 miles in thickness. How is all this enormous temperature sustained? If the sun were a solid block of coal and were it allowed a sufficient supply of oxygen, to enable it to burn at the rate necessary to produce the observed emission, it would utterly be consumed in 5,000 years—what then sustains the solar heat? Meteors may feed the sun, and by the conversion of their motion—their mechanical force—into heat, sustain the temperature of that great and distant 'star.' An asteroid on striking the sun with a velocity of 390 miles a second—the speed acquired if it approached the sun from an infinite distance—would develope more than 9,000 times the heat generated by the combustion of an equal asteroid of solid coal. If it approached the sun at the lowest possible speed, namely, that of 276 miles a second, it would, on striking, develope heat equal to the combustion of 4,000 such asteroids of solid coal. Supposing a brake were applied to the surface of the sun and planets, until the motion of rotation has entirely stopped, the heat developed would cover the solar emission for 134 years, while the heat of gravitation, if all the planets fell into the sun, would cover the emission for 45,589 years. These results follow directly and necessarily from the application of the mechanical equivalent of heat to cosmical matters. If the number representing the mechanical equivalent of heat should be found to be to excess or defect, these results would have to be varied, but the great facts embodied in the 'New Philosophy' remain the same.

One single instance will suffice to shew the care which the student must exercise in endeavoring to arrive at the true source of heat in any given case.

Suppose, for instance, that we turn a mill by the action of the tide, and produce heat by the friction of the millstones; that heat has an origin totally different from the heat produced by another pair of millstones which are turned by a mountain stream. The former is produced at the expense of the earth's rotation round its axis; the latter at the expense of the sun's radiation, which lifted the millstream to its source, in the form of invisible vapor, subsequently condensed, and made to assume the form of rain or snow.

PROVINCIAL EXHIBITION PRIZES.

The following is the corrected List of Prizes awarded in the ARTS and MANUFACTURES department of the Provincial Exhibition, held in the City of Kingston in September last.

PRIZE LIST.

CLASS XXXVIII.—CABINET WARE AND OTHER WOOD MANUFACTURES—(31 Entries.)

Judges.—G. Stephens, Cobourg; W. Irving, Kingston; and F. S. Clench, Cobourg.

Best set of Bedroom Furniture, S. T. Drennan, Kingston, $10.

Best Centre Table, S. T. Drennan, Kingston, $7.

Best Drawing Room Sofa, S. T. Drennan, Kingston, $7.

Best set of Drawing Room Chairs, S. T. Drennan, Kingston, $7.

Best Sideboard, S. T. Drennan, Kingston, $6.

Best Coopers' Work, S. O. Grady, Oil Springs, $4; 2nd do., Andrew Bridge, Kingston Tp, $3.

Best dozen Corn Brooms, R. L. Clark, Ernestown, $2.

Best assortment of Joiners' Work, Anson Storm, Odessa, $8.

Best Veneers from Canadian Woods, undressed, Wm. Clement, Newburg, $8.

Extra Entries.

Patent Bee-Hive, and Bees, S. D. Purdy, Collins' Bay, $2; Bee-Hive, David Purdy, Kingston Tp, $3;

Washing Machine, H. P. Clow, Napanee, $3; Bee-Hive, George Walker, Kingston Tp, $4; Bee-Hive, J. M. Grover, Colborne, $4; Window Blind and Sun Shade, W. J. Lucas, London, Diploma and $6; Cricket Bats and Wickets, W. Peacock, Montreal, $5; Roller Wash Board, S. J. Ward, Belleville, $2; Beech Wood Knot, F. Burrowes, King, $4; Machine wrought Siding, A. Storm, Odessa, $2; Washing Machine, N. H. Nutting, Marysburg, $5.

Remarks.—The judges regret to find so few entries in Cabinet Ware, and having learned from cards on the furniture entered, that all the articles shown were from the Penitentiary, we think that this is the cause of no other entries being made. We therefore doubt the propriety of allowing this work to come in competition with that of the honest mechanics of the Province.

CLASS XXXIX.—Carriages and Sleighs, and Parts Thereof—(82 Entries.)

Judges.—M. Donovan, Whitby; E. Cooney, Cobourg; J. Falconer, Kingston.

Best wrought Iron Axle, A. C. Chewett & Co., Kingston, $3 and Diploma; 2nd do., Byers and Matthew, Gananoque, $2.

Best bent Shafts, half a dozen, R. McKinley & Co., St. Catharines. $3; 2nd do., Fralick, Bros., Picton, $2.

Best Bows for carriage tops, two sets, R. McKinley & Co., St. Catharines, $3.

Best double seated Buggy, Hart & Son, Picton, $8; 2nd do., Samuel Lake, Newburgh, $4.

Best single seated Buggy, Fralick Bros., Picton, $7.

Best two horse pleasure Carriage, Hart & Son, Picton, $12; 2nd do., A Titus, Farmersville, $7.

Best one horse pleasure Carriage, Fralick Bros., Picton, $8; 2nd do., S. Lake, Newburgh, $4.

Best two pairs carriage Hubs, John Eakin, Markham, $3; 2nd do., do., do., $2.

Best two pairs carriage Rims or Felloes, R. McKinley & Co., St. Catharines, $2; 2nd do., Fralick Bros., Picton, $1.

Best dozen machine made carriage Spokes, T. C. Saunders, St. Catharines, $3 and Diploma.

Best two horse pleasure Sleigh, Hart & Son, Picton, $10; 2nd do., do., do., $6.

Best one horse pleasure Sleigh, Fralick Bros., Picton, $8; 2nd do., S. Lake, Newburgh, $4.

Best Sulky, Trotting, Samuel Lake, Newburgh, 2nd prize, $3.

Extra Entries.

Best seat rails for Buggies, Fralick Bros., Picton, $2. Carriage Hub and Axle, (all iron) A. C. Chewett & Co., Kingston, $3 and Diploma.

2 sets of Bent Rims for buggies, R. McKinley & Co., St. Catharines, $2; 2 sets do. do., for Waggons, $2; for Sulkies, do., do., do., $2.

Assortment of Bent Stuff for waggons, sleighs, and buggies, R. McKinley & Co., St. Catharines, $5.

Assortment of Spokes for waggons, sulkies, and buggies, Thomas C. Saunders, St. Catharines, $2.

Remarks.—The judges regret not finding a larger assortment of manufactured articles in class 39, but hope at next annual Exhibition to find an improvement in that respect.

CLASS XL.—Chemical Manufactures and Preparations—(22 Entries.)

Judges—Dr. Holden, Guelph; Dr. Beatty, Cobourg.

Best assortment of essential Oils, Lyman, Clare & Co., Montreal, $6; 2nd do., J. A. Taylor & Co., Napanee, $4.

Best Medicinal Herbs, Roots, and Plants, native growth, T. W. Poole, Norwood, $12; 2nd do., W. Saunders, London, $7.

Best Oils, Linseed and Rape, and other expressed kinds, Lyman Clare & Co., Montreal, $6.

Best Oils, Coal, Shale or Rock, W. Esmonde & Co., Oakville, $6; 2nd do., Parson, Bros., Toronto, $4.

Best Oil, Neat's Foot, half gallon, Lyman Clare & Co., Montreal, $2.

Best assortment of Varnishes, Lyman, Clare & Co., Montreal, $6.

Extra Entries.

Shoe Blacking, G. Robertson, Kingston, $2; Ground Paint, Lyman, Clare & Co., Montreal, $6; Assorted Perfumery, do., do., do., $3; Assorted Perfumery and Hair Brushes, G. S. Hobart, Kingston, Diploma; Assortment of Perfumery; Pomades &c., John A. Taylor, Napanee, $2; Benzole or Mineral Turpentine, Parson Bros., Toronto, $2; Powdered Drugs, Lyman, Clare & Co., Montreal, $6 and Diploma; Ground Dye Stuffs, Lyman, Clare & Co., Montreal, $4.

CLASS XLI.—Decorative and Useful Arts, Drawings and Designs—(69 Entries.)

Judges.—John Shier, Whitby; Henry Langley, Toronto.

Best Carving in Wood, S. J. Seaman, Brockville, $6; 2nd do., do., do., $4.

Best Decorative House Painting, G. D. Lucas, Toronto, $5.

Best Decorative Sign Writing, on glass, G. D. Lucas, Toronto, $4; 2nd do., F. Richardson, Napanee, $2.

Best Geometrical Drawing of Engine or Mill Work, coloured, G. P. Drummond, Mitchell, 2nd prize, $3.

Best Lithographic Drawing, W. C. Chewett, & Co., Toronto, $5; 2nd do., Brown & Bank, Hamilton, $3.

Best Lithographic Drawing, coloured, W. C. Chewett & Co., Toronto, $6; 2nd do., Brown & Bank, Hamilton, $4.

Best Map of Canada, lithographed, G. Tremaine, Toronto, $6.

Best Mathematical, Philosophical, and Surveyor's Instruments, collection of, A. F. Potter, Toronto, $15; 2nd do., Wm. Quinton, Kingston, $10.

Best Picture Frame, ornamented gilt, A. J. Pell, Montreal, $5.

Best Penmanship, business hand, H. Wright, Toronto, $4; 2nd do., do., Bryant Stratton, & Day, Toronto, $2.

Best Sign Writing, G. D. Lucas, Toronto, $4.

Extra Entries.

Gold and Silver Leaf, C. H. Hubbard, Toronto, $5; Dentist's Gold and Silver Foil, do., do., $5; Weather Indicator, G. Wolfe, Bridgwater, $3; Sun Dial, W. H. Sheppard, Toronto, $5; Water Metre, James Hurlburt, Reach, $5; Lithographic Printing, check books, copy books, &c., Brown & Bank, Hamilton, $3; Lithographic Printing, W. C. Chewett & Co., Toronto, $5; Carving in Marble, E. Strong, Kingston, $3; Chess Board Table Top, in water colours, R. W. Taylor, Kingston, $3; Specimen of Marble, William Knowles, Arnprior, $5.

CLASS XLII.—Fine Arts—(189 Entries.)

Judges.—J. D. Humphreys, Toronto; F. J. Rastrick, Hamilton; W. H. Peterson, Guelph.

Professional List.—Oil.

Best Animals, grouped or single, W. N. Cresswell, Harpurhey, $12; 2nd do., R. Whale, Burford, $7.

Best Historical Painting, R. Whale, Burford, $12; 2nd do., W. N. Cresswell, Harpurhey, $7.

Best Landscape, Canadian subject, W. N. Cresswell, Harpurhey, $12; 2nd do., R. Whale, Burford, $7.

Best Landscape or Marine Painting, not Canadian subject, W. N. Cresswell, Harpurhey, $10; 2nd do; 2nd do., F. Richardson, Napanee, $6.

Best Marine Painting, Canadian subject, W. N. Cresswell, Harpurhey, $12; 2nd do., do., do., $7.

Best Portrait, W. Sawyer, Kingston, $10; 2nd do., do., do., $6.

In Water Colours.

Best Animals, grouped or single, W. N. Cresswell, Harpurhey, $7.

Best Flowers, grouped or single, John Griffith, London, $7; 2nd do., Miss Amelia F. H. Gibbon, Weston, $5.

Best Landscape, Canadian subject, Captain Caddy, Hamilton, $7; 2nd do., W. N. Cresswell, Harpurhey, $5.

Best Landscape or Marine Painting, not Canadian subject, W. N. Cresswell, Harpurhey, $7; 2nd do., Captain Caddy, Hamiltou, $5.

Best Marine Painting, Canadian subject, W. N. Cresswell, Harpurhey, $7.

Pencil, Crayon, &c.

Best Crayon, coloured, Miss Amelia F. H. Gibbon, Weston, $6.

Best Crayon, plain, Miss Lucy Ritchie, Kingston, $6; 2nd do., do., do., $4.

Best Pencil Drawing, Miss Amelia F. H. Gibbon, Weston, $6.

Best Pen and Ink Sketch, Miss Amelia F. H. Gibbon, Weston, $6; 2nd do., F. A. Verner, Toronto $4.

Amateur List—Oil.

Best Animals, grouped or single, John H. Whale, Burford, $8; 2nd do., do., do., $5.

Best Historical Painting, John H. Whale, Burford, $8; 2nd do., Miss M. Gordon, Port Colborne, $5.

Best Landscape, Canadian subject, John H. Whale, Burford, $8; 2nd do., do., do., $5.

Best Landscape or Marine Painting, not Canadian subject, John H. Whale, Burford, $8; 2nd do., Miss M. Gordon, Port Colborne, $5.

Best Marine Painting, Canadian subject, John H. Whale, Burford, $8.

Best Portrait, John H. Whale, Burford, $7; 2nd do., do., do., $5.

In Water Colours.

Best Animals, grouped or single, D. Fowler, Amherst Island, $7; 2nd do., Miss Georgina Holland, Bowmanville, $5.

Best Flowers, grouped or single, James Griffith, London, $5; 2nd do., D. Fowler, Amherst Island, $3.

Best Landscape, Canadian subject, D. Fowler, Amherst Island, $7; 2nd do., T. D. Belfield, Grafton, $5.

Best Landscape or Marine Painting, not Canadian subject, T. D. Belfield, Grafton, $7; 2nd do., Mrs. Berry, Kingston, $5.

Best Marine View, Canadian subject, T. D. Belfield, Grafton, $7.

Best Portrait, D. Fowler, Amherst Island, $6.

Pencil, Crayon, &c.

Best Crayon, coloured, Miss Thomson, Kingston, $5; 2nd do., D. Fowler, Amherst Island, $3.

Best Crayon or Pencil Portrait, D. Fowler, Amherst Island, $5; 2nd do., Miss Elizabeth Robertson, Colborne, $3.

Best Pencil Drawing, E. M. Edmonds, Burnstown, $5; 2nd do., D. Fowler, Amherst Island, $3.

Best Crayon, plain, E. A. Mara, Ottawa, $5; 2nd do., Miss Thomson, Kingston, $3.

Best Pen and Ink Sketch, J. T. Burnside, Cobourg, $5; 2nd do., do., do., $3.

Photography.

Best Collection of Ambrotypes, H. K. Sheldon, Kingston, $6.

Best Collection of Photograph Portraits, in duplicate, one set coloured, R. W. Anderson, Toronto, $10.

Best Collection of Photograph Portraits, plain, H. K. Sheldon, Kingston, $8; 2nd do., Stanton, Cox & Hayden, Cobourg, $5.

Best Collection of Photograph Landscapes and Views, Miss M. Kedgill, Kingston, $8; 2nd do., R. W. Anderson, Toronto, $5.

Best Photograph Portraits in Oil, W. Sawyer, Kingston, $8; 2nd do., do., do., $5.

Extra Prizes.

Professional, Fruit in Oil, R. A. Pauling, Hamilton $4; Photograph in Water Colours, Stanton, Cox & Hayden, Cobourg, $4; Painting in Velvet, R. W. Taylor, Kingston, $3.

CLASS XLIII.—Groceries and Provisions—(76 Entries.)

Judges.—A. McNaughton, Newcastle; T. Beeman, Napanee.

Best Barley, pearl, A. W. Ogilvie & Co., Montreal, $3; 2nd do., D. Hooper, Newburg, $2.

Best Barley, pot, A. W. Ogilvie & Co., Montreal, $3; 2nd do., D. Campbell, Charlottenburgh, $2.

Best Bottled Fruits, an assortment, manufactured for sale, Miss Mary Ann Dumble, Kingston, 2nd prize, $4.

Best Bottled Pickles, an assortment, manufactured for sale, A. H. Campbell, Storrington, $6.

Best Buckwheat Flour, D. Hooper, Newburgh, $3; 2nd do., R. Denison, Napanee, $2.

Best Chicory, 20 lb. of, George Robertson, Kingston, $3.

Best Indian Corn Meal, Ogilvie & Co., Montreal $3; 2nd do., D. Hooper, Newburgh, $2.

Best Mustard, one jar, F. H. Ewing & Co. Montreal, $2.

Best Oatmeal, James Russell, Pickering, $3.

Best Soap, one box of common, P. Freeland & Co., Toronto, $4; 2nd do., do., do., $3.

Best Soaps, collection of assorted fancy, G. S. Hobart, Kingston, $6; 2nd do., Samuel Phippin, do., $4.

Best Spices, ground, an assortment of, Lyman, Clare & Co., Montreal, $2; 2nd do., Geo. Robertson, Kingston, $1.

Best Starch, 12 lbs. of corn, Benson & Aspden, Edwardsburgh, $2.

Best Tobacco, 14 lbs., Canadian manufacture, S. S. Preston, Toronto, $4 and Diploma.

Best Wheat Flower, G. Wheler, Uxbridge, $5; 2nd do., James Durand, Kingston, $3.

Extra Entries.

Two Dozen Ale, James Fisher, Portsmith, $2; 1 Box Candles, Samuel Phippin, Kingston, $3; Ground Coffee and Rice, J. A. Karch, Kingston, $2, Cigars, Canadian manufacture, S. Oberndorffer & Co., Kingston, Diploma; Prepared Corn for Food, Benson & Aspden, Fredericksburg, $2; Ground Coffee, George Robertson, Kingston, $2; Preserves in Jars, H. Dumble, Kingston, $1; Bottled Pale Ale, L. Livingston, Kingston, $3; Loaf of Home Made Bread, F. Bibby, Kingston, $1; Mustard Pickled Cucumbers, Mrs. Weinecker, Waterloo, $1; Preserves in Jars, E. Jackson, Kingston, $4.

CLASS XLIV.—LADIES WORK—(325 Entries.)

Judges.—Mrs. F. Burnett, Cobourg; Mrs. W. H. Sheppard, Toronto; Miss Hattie Stephens, Cobourg.

Best Bead Work, Miss P. Lenea, Kingston, $3; 2nd do., do., do., $2; 3rd do., S. A. Bibby, do., $1.

Best Braiding, Mary Ann Dumble, Kingston, $3; 2nd do., do., do., $2; 3rd do., Miss H. Bidwell, Colborne, $1.

Best Crotchet Work, Miss Phillips, Prescott, $3; 2nd do., W. Wolf, Storrington, $2; 3rd do., E. T. Hill, Kingston, $1.

Best Embroidery in Muslin, J. G. Strachan, Pittsburg, $3; 2nd do., Mary Ann Dumble, Kingston, $2; 3rd do., Miss J. A. Ramsay, Pittsburg, $1.

Best Embroidery in Silk, Miss Scott, Prescott, $3; 2nd do., Mrs. T. Wilson, Kingston, $2; 3rd do., Miss Bennett, Cobourg, $1.

Best Gloves, three pairs, Mrs. Platt Hinman, Haldimand, $2; 2nd do., Mrs. Edward Jackson, Kingston, $1; 3rd do., Mrs. Litchfield, Portsmouth, 50c.

Best Guipure Work, Miss H. Bidwell, Colborne, $3; 2nd do., do., do., $2; 3rd do., Elizabeth T. Hill, Kingston, $1.

Best Hair Work, Mary Rattenbury, Harpurhey, $3; 2nd do., Annie Robertson, Colborne. $2; 3rd do., J. Hitchcock, Portsmouth, $1.

Best Knitting, Miss J. A. Ramsay, Pittsburg, $3; 2ud do., Mrs. Unwin, Toronto, $2, 3rd do., Mrs. P. Perry, Whitby, $1.

Best Lace Work, Miss H. Bidwell, Colborne, $3; 2nd do., Alice L. Hill, Kingston, $2; 3rd do., Mrs. A. M. Mills, $1. Extra—Mrs. Mary Hart, Port Hope, $3.

Best Mittens, three pairs of woollen, Mrs. E. Jackson, Township of Kingston, $2; 2nd do., Mrs. Platt Hinman, Haldimand, $1; 3rd do., Mrs. E. Jackson, Township of Kingston, 50c.

Best Needle Work, ornamental, J. A. Ramsay, Pittsburg, $2; 2nd do., Miss Dwyer, Kingston, $2; 3rd do., Margaret Mann, Brockville, $1.

Best Netting, fancy, Mary R. Hill, Kingston, $3; 2nd do., S. Hyman, Kingston, $2; 3rd do., Mary R. Hill, Kingston, $1.

Best Plait for Bonnets or Hats, of Canadian straw, John Hopkins, Collins' Bay, $3; 2nd do., do., do., $2; 3rd do., Mrs. H. Stickle, Cobourg, $1.

Best Shirt, gentleman's, Margaret Mann, Brockville, $3; 2nd do., Miss Bennett, Cobourg, $2; 3rd do., do., do., $1.

Best Socks, three pairs of woollen, Mrs. Platt Hinman, Haldimand, $2; 2nd do., Miss Bennett, Cobourg, $1; 3rd do, E. Jackson, Township of Kingston, 50c.

Best Stockings, three pairs of woollen, Mrs. Bennett, Cobourg, $2; 2nd do., Mrs. E. Jackson, Kingston, $1; 3rd do., R. L. Clark, Ernestown, 50c.

Best Tatting, J. A. Ramsay, Pittsburg, $3; 2nd do., A. L. Hill, Kingston, $2; 3rd do., C. F. Dupuy, Kingston, $1.

Best Wax Fruit, Miss L. Purvis, Mallorytown, $6; 2nd do., Mrs. Jacob Bajus, Kingston, $4; 3rd do., J. A. Ramsay, Pittsburg, $2.

Best Wax Flowers, Mrs. Jacob Bajus, Kingston, $6; 2nd do., Arch McGreer, Napanee, $5; 3rd do., J. A. Ramsay, Pittsburg, $2.

Best Worsted Work, Mrs. Unwin, Toronto, $3; 2nd do., J. A. Ramsay, Pittsburg, $2; 3rd do., Charlotte Spencer, Kingston, $1.

Best Worsted Work (fancy) for framing, W. Wolf, Storrington, $3; 2nd do., S. D. Purdy, Collin's Bay, $2; 3rd do., Mrs. Ferris, Kingston, $1.

Best Worsted Work, raised, J. A. Ramsay, Pittsburg, $3; 2nd do., Miss Abercrombie, Picton, $2; 3rd do., J. A. Ramsay, Pittsburg, $1.

Extra Entries.

Fancy Quilt, piece work, Mrs. Amey, Camden, $1; Sample Machine Sewing. R. Wanzer & Co., Hamilton, $2; Fancy Quilts, Mrs. Bowman, Kingston, $2; Farmer's Wreath, made from seeds, Mrs. Fairman, Pittsburg, $3; Moss Wreath, Mrs. Storm, Ernestown, $1; Bed Quilts, Mrs. A. M. Mills, Kingston, $2; Straw Bonnetts and Hats, Mrs. John Hopkins, Collin's Bay, $3; Wax Baskets, Mrs. Jacob Bajus, Kingston, $4; Cone Vase and Frame Work, Miss Mary Ann Jones, Kingston, $6; Model Cottage and Moss Wreath, Mrs. Mary Lane, Belleville, $6; Feather Wreath and Bouquet, Mrs. Hitchcock, Portsmouth, $3; Farmers' Wreath and Patched Quilts, Miss A. J. Peck, Ameliasburg, $5; Quilt, Mrs. Miller, North Fredericksburg, $2; Leather Work Frame and Paper Flowers, Mrs. Dunn, Kingston, $2; Quilt, Mrs. Briscoe, Kingston, $1; Feather Flowers, Mrs. Meadows, Kingston, $2; Muslin and Wax Flowers, Mrs. G. Hunte, Kingston, $3; Case of Millinery, Mrs. Angline, Kingston, $4; Landscape, Miss Sarah Webster, Montreal, $3; Moss and Shell Work, Miss Harris, Kingston, $2; Silver Wire Flowers, Miss M. Gordon, Port Colborne $3; Chenille Work, Miss Duryee, Kingston, $3; Bonnets and Head Dresses, Mrs. W. P. Lacey, Kingston, $4; Quilt, Miss W. D. Wood, Cornwall, $2; Wax Vase and Wreath, Mrs. Bajus, Kingston,

$3; Cordon Work, Miss H. Bidwell, Colborne, $2; Dried Sea Mosses, Mrs. Jesse Thayer, Montreal, $4.

XLV. — MACHINERY, CASTINGS, AND TOOLS—(43 Entries.)

Judges.—T. Wilson, Cobourg; G. Bickell, Dundas; James Smith, Smith's Falls.

Best Edge Tools, an assortment, Fotheringham & Workman, Montreal, $15; 2nd do., J. W. Robinson, Bridgewater, $10.

Best Pump, in metal, John Brokenshire, Kingston, $5.

Best Refrigerator, Chown & Cunningham, Kingston, $6; 2nd do., R. M. Horsey, Kingston, $4.

Best Sewing Machine, manufacturing, R. M. Wanzer & Co., Hamilton, $8; 2nd do., Irwin & White, Belleville, $5.

Best Sewing Machine, family, Irwin & White, Belleville, $8; 2nd do., R. M. Wanzer & Co., Hamilton, $5.

Best Skates, an assortment of, D. F. Jones & Co., Gananoque, $6.

Extra Entries.

Sewing Machine Needles, R. Wanzer & Co., Hamilton, commended; Blacksmiths' Tuyere Iron, for forge, Eckardt & Jones, Markham, commended; Hand-power Wood-sawing Machine, Bender & Lewis, Clifton, $4; Another do., Richmond & Thomas, London, $2; Model of Railway Switches, J. Kitching, Kingston, Diploma; two Cases of Augurs, Fotheringham & Workman, Kingston, $6; Coopers' Tools, H. H. Date, Galt, $5; Water-wheel, R. N. Kendall, Coaticoke, C. E., Diploma; Steam Amalgam Bells, A. T. Button & Co., Uxbridge, $6; Hot and Cold Grain Dryer, Sutton & Gibson, Brantford, Diploma.

CLASS XLVI.—METAL WORK (MISCELLANEOUS) INCLUDING STOVES—(78 Entries.)

Judges. — N. McNeil, Kingston; W. McMichael, Waterford; S. Shaw, Smith's Falls.

Miscellaneous.

Best Coal Oil Lamps, an assortment, R. M. Horsey, Kingston, $8.

Best Coppersmith's Work, an assortment, J. G. Beard & Sons, Toronto, $7; 2nd do., R. M. Horsey, Kingston, $4.

Best Engineers' Brass Work, an assortment, T. C. Collins, Toronto, $6.

Best Iron Fencing and Gate, ornamented, Chown & Cunningham, Kingston, $7.

Best Iron Work, ornamented cast, Chown & Cunningham, Kingston, $6.

Best Nails, 20 lbs. of pressed, Cowan & Britton, Gananoque, 2nd prize, $4.

Best Nails, 20 lbs. of cut, Cowan & Britton, Gananoque, 2nd prize, $4.

Best Plumber's Work, an assortment, G. McDonald, Kingston, $6.

Best Screws and Bolts, an assortment, F. Fairman, Gananoque, $6.

Best Tinsmiths' Work, an assortment, R. M. Horsey, Kingston, $6; 2nd do., Chown & Cunningham, do., $4.

Best Tinsmith's Lacquered Work, an assortment of, Chown & Cunningham, Kingston, $6; 2nd do., R. M. Horsey, Kingston, $4.

Stoves.

Best Cooking Stove, for wood, John McGee, Toronto, $6; 2nd do., Chown & Cunningham, Kingston, $4.

Best Cooking Stove, for coal, J. G. Beard & Son, Toronto, $6; 2nd do., John McGee, Toronto, $4.

Best Furniture for Cooking Stove, one set, G. Chown Kingston, $4; 2nd do., Chown & Cunningham, do., $3.

Best Hall Stove, for wood, J. G. Beard & Son, Toronto, $5; 2nd do., John McGee, do., $3.

Best Hall Stove for Coal, J. G. Beard & Co., Toronto, $5; 2nd do., $3.

Best Parlour Stove, for wood, J. R. Armstrong, Toronto, $6; 2nd do., J. G. Beard & Son, do., $3.

Best Parlour Stove, for coal, Jn. McGee, Toronto, $5. 2nd do., J. G. Beard & Son, do., $3.

Extra Entries.

Zinc and Iron Shoe Nails, Cowan & Britton, Gananoque, commended; Bar Iron Manufactured from Scrap, A. C. Chewett & Co., Kingston, $4; Bar Iron from Native Ore, A. C. Chewett & Co., Kingston, $4; Steel for Sleigh Shoes, A. C. Chewett & Co., Kingston, $4; Boiler and Bridge Rivets from Scrap Iron, A. C. Chewett & Co., Kingston, $2; Set of Weights and Measures, Hiram Piper, Toronto, $6. Signal Lamp, for vessels, Hiram Piper, Toronto, $4; Specimen of Electro-plating, Wallace Millichamp, Toronto, $8; Forged Work, Thos. L. Wilson, Kingston, Diploma and $6.

CLASS XLVII.—MISCELLANEOUS, INCLUDING POTTERY AND INDIAN WORK—(64 Entries.)

Judges.—J. F. Wright, Vienna; J. A. Tarbox, Hamilton; D. McMillan, Dundas.

Best Artificial Leg, John Condell, Brockville, $6.

Best Artificial Arm, do., do., $6.

Best Brushes, an assortment, Alfred Green, Hamilton, $6.

Best Model of a Steam Vessel, Richard Osborne, Newburg, $6.

Best Model of a Sailing Vessel, Andrew Rea, Kingston, $6; 2nd do., James Heasley, Kingston, $4.

Best Stoneware, an assortment, S. Skinner & Co., Hallowell, $10.

Best Slates for Roofing, Benjamin Walton, Toronto, $8.

Best Buckskin Mittens, one pair, James H. Peck, Albury, $2; 2nd do., Groin & Mayer, Kingston, $1.

Best Mocassins, one pair of plain, Groin & Mayer, Kingston, $2.

Best Mocassins, worked with beads or porcupine quills, one pair, Betsey, Caughnawaga, $3.

Extra Entries.

Garden Tiles for Walk Edges, Bateman Losee, Cobourg, $4; Skiff, Marshall Bros., Kingston, Diploma; Pleasure Boat, M. V. German, Kingston, Diploma; 3 Pairs Sweep Oars and 6 Paddles, do., do., Diploma; Pleasure Skiff, do., do., $5; 3 Pairs of Spoon Blade Oars, Diploma; Red Brick, D. Campbell, Charlottenburg, $3; Row Boats, H. Tomlinson, Portsmouth, Diploma; Collection of Whisks, J. L. Stranahan, Toronto, $1; 2 Watch Pockets, (Indian work) Betsey——, Caughnawaga

$1; Pin Cushion, do., do., 50c.; Smoking Cap, Mary ———, do., $1; Running Man Target, Martin Scott, Kingston, $1.

CLASS XLVIII.—MUSICAL INSTRUMENTS—(14 Entries.)

Judges.—John Carter, Toronto; A. W. Murdock. Kingston.

Best Harmonium, Andrus Brothers, London, $10.

Best Melodeon, R. S. Williams, Toronto, $6; 2nd do., Andrus Brothers, London, $4.

Best Piano, square, J. C. Fox, Kingston, $15.

Extra.

Military Brass Drum, R. S. Williams, Toronto, Diploma.

REMARKS.—The judges having examined the several instruments in the Crystal Palace, in addition to the prizes awarded, they wish to speak favourably of several instruments (Melodeons, Organs, &c.,) exhibited by D. W. Caldwell, of Kingston, in the Foreign Class. In deciding the prizes for Melodeons, they hesitated much as to which of the competitors to award the 1st prize, but finding the finish of those by Williams somewhat superior, they agreed to recommend that the 1st prize be awarded him.

CLASS XLIX.—NATURAL HISTORY—(10 Entries.)

Judges.—Professor Lawson, Kingston; Professor Buckland, Toronto.

Best Collection of Native Insects, classified, and common and technical names attached, R. V. Rogers, Kingston, $8.

Best Collection of Minerals of Canada, named and classified, A. T. Drummond, Kingston, $8.

Best Collection of Native Plants, arranged in their natural families and named, John Macoun, Belleville, $8; 2nd do., Thos. W. Poole, Norwood, $5; 3rd do., John Bell, Kingston, $3.

Best Collection of the Woods of Canada, in boards two feet long, one side polished; also, a portion of the tree cut in sections showing the bark, Nathaniel Leonard, Westbrook, $8.

Extra.

Collection of Canadian Shells, A. T. Drummond, Kingston, $3.

CLASS L.—PAPER, PRINTING, BOOKBINDING, AND TYPE—(41 Entries.)

Judges.—John Creighton, Kingston; Wm. Halley, Toronto.

Best Bookbinding, (blank book) assortment of, Thomas McAuley, Kingston, $5; 2nd do., Brown Brothers, Toronto, $3.

Best Bookbinding, letter-press, Brown Brothers, Toronto, $5; 2nd do., Dredge & Wilson, Toronto, $3.

Best Letter-press Printing, plain, Donelly & Lawson, Hamilton, $5; 2nd do., George Brown, Toronto, $3.

Best Letter-press Printing, ornamental, George Brown, Toronto, $5; 2nd do., W. Lightfoot, Kingston, $3.

Paper Hangings, Canadian paper, one dozen rolls, assorted, W. Robinson, Kingston, $6; 2nd do., do., do., $4.

Best Papers, (printing, writing and wrapping) one ream of each, A. Buntin & Co., Montreal, $6; 2nd do., Angus and Logan, Montreal, $4.

Best Papers, (blotting and coloured) one ream of each, A. Buntin & Co., Montreal, $6.

Best Pocket Books, Wallets, &c., as assortment, Brown Brothers, Toronto, $6.

Extra Prizes.

A Buntin & Co., Montreal, $1; Bill Cases and Blotting Cases, Brown Bros., Toronto, $1; Card Cases, do., do., $2; Ornamented Posters, George Brown, Toronto, $1; Plain Cards, do., do., $1; Ornamented, do., do., do., $1; General Job Printing, do., do., $2; Envelopes, P. B. Martin, Montreal, 50c.

REMARKS.—The judges regret that no very good specimen of Book Printing, has been entered for competition, and they think that in future a special prize should be given for Book and Fine Wood-cut Printing.

CLASS LI.—SADDLE, ENGINE HOSE, AND TRUNK MAKERS' WORK, AND LEATHER—(48 Entries.)

Judges.—T. Morrow, Cobourg; and W. Edwards, Toronto.

Best Harness, set of double carriage, Marshall Porter, Bowmanville, 2nd prize, $5.

Best Harness, set of single carriage, do., do., 2nd prize, $4.

Best Harness, set of team, do., do., $5.

Best Hames, six pair of wooden team, S. Skinner, Gananoque, $3.

Leather.

Best Belt Leather, 30lbs., John Bartle, Chippawa, $3; 2nd do., S. S. Wartman, Camden, $2.

Best Brown Strap and Bridle, one side of each, John Billing & Co., Galt, $3 and Diploma; 2nd do., S. S. Wartman, Camden, $2.

Best Carriage Covers, two skins, John Billing & Co., Galt, $3.

Best Deer Skins, dressed, Jacob De Witt, Montreal, $2.

Best Harness Leather, two sides, Robt. Lingwood, Fergus, $3; 2nd do., John Billing & Co., Galt, $2.

Best Hog-skins for Saddles, three, John Billing & Co., Galt, $4; 2nd do., Robert Lingwood & Co., Fergus, $3.

Best Skirting for Saddles, two sides, John Bartle, Chippawa, $4; 2nd do., John Billing & Co., Galt, $3.

Extra Entries.

One Side Black Bridle Leather, John Billing & Co., Galt, $2; Two Sides Collar Leather, do., do., $2; Two Sides of Hose Leather, do., do., $2; Silver and Brass Plated Hames, S. Skinner, Gananoque, Diploma; Assorted Collection of Hames, do., do., $4; Calf Kid for Shoe Work, Jacob De Witt, Montreal, $2; Calf Kid for Glove Work, do., do., Diploma; White Organ Leather, do., do., $3; Leather Belting in Rolls, L. J. Campbell & Co., Montreal, Diploma; Carriage and Harness Silver Plated Mountings, Wallace Millichamp, Toronto, Diploma.

REMARKS.—The judges regret that the competition in this class is so very small. The double and single sets of harness exhibited, are not got up in sufficiently good taste to warrant the awarding of first prizes. The six specimens of harness leather exhibited, are of very superior quality, and entitled to the highest commendation.

CLASS LII.—SHOE AND BOOT MAKERS' WORK, LEATHER, &c.—(64 Entries.)

Boots &c.

Judges.—J. Bain, Whitby; S. S. Madden, Napanee; and W. H. Ball, Scotland.

Best Boots, ladies', an assortment, A. Sutherland, Kingston, $7; 2nd do., W. Allan, Kingston, $4.
Best Boots, gentleman's sewed, assortment, W. Allan, Kingston, $7; 2nd do., A. Sutherland, Kingston, $4.
Best Boots, pegged, an assortment, A. Sutherland, Kingston, $5; 2nd do., Kirk & Row, Kingston, $3.
Boot and Shoemakers' Lasts and Trees, an assortment, M. Selway, Toronto, $8; 2nd do., James Bullock, Lyn, $5.
Best Shoemakers' Pegs, an assortment, W. A. Young, Carlisle, $4.

Leather.

Best Calf Skins, John Billing & Co., Galt, $3; 2nd do., R. Lingwood, Fergus, $2.
Best Calf Skins, grained, R. Lingwood, Fergus, $3; 2nd do., Thomas Fowke, Darlington, $2.
Best Calf Skins, two morocco, R. Lingwood, Fergus, $3; 2nd do., John Bartle, Chippawa, $2.
Best Cordovan, two skins of, Robert Lingwood, Fergus, $3; 2nd do., John Billing & Co., Galt, $2.
Best Dog Skins, two dressed, Thomas Fowke, Darlington, $3.
Best Kip Skins, two sides, John Bartle, Chippawa, $3; 2nd do., Thos. Fowke, Darlington, $2.
Best Kip Skins, grained, Thos. Fowke, Darlington, $3; 2nd do., John Billing & Co., Galt, $2.
Best Linings, six skins, R. Lingwood, Fergus, second prize, $2.
Sheep Skins, six coloured, John Billing & Co., Galt, $3.
Best Sole Leather, two sides, Robert Lingwood, Fergus, $3; 2nd do., R. Campbell, Portsmouth, $2.
Best Upper Leather, two sides, John Bartle, Chippawa, $3; 2nd do., R. Lingwood, Fergus, $2.
Best Upper Leather, grained, two sides, Thomas Fowke, Darlington, $3; 2nd do., Robert Lingwood, Fergus, $2.

Extras.

Split Leather, John Billing & Co., Galt, $2; Bellows Leather, do., do., $2; Card Leather, do., do., $2; Waxed Grain Leather, Robert Lingwood, Fergus, $1; Screw Power Boot Treeing Machine, W. A. Young, Carlisle, $3; Double Lever Boot Crimping Machine, do., do., $5; Stretching and Rubbing Down Machine, do., do., $1 50; Lever Power Boot Treeing Machine, do., do., $2; Balmoral Shoe Tops, machine made, G. W. Folts, Toronto, 50c.

CLASS LIII.—WOOLLEN, FLAX, AND COTTON GOODS; AND FURS AND WEARING APPEARL—(175 Entries.)

Judges.—G. W. Weaver, Montreal; W. Hamilton, Toronto; and H. M. Melville, Hamilton.

Best Bags, from flax or hemp, the growth of Canada, one dozen, Robert Denison, Napanee, $5; 2nd do., D. Campbell, Charlottenburg, $4.
Best Blankets, woollen, one pair, Daniel Campbell, Charlottenburg, $6; 2nd do., Mrs. Anne J. Waldron, Storrington, $4.
Best Carpet, woollen, one piece, E. Snider, Elizabethtown, $8; 2nd do., N. Dollar, North Fredericksburg, $5.
Best Carpet, woollen stair, one piece, E. Snider, Elizabethtown, $6; 2nd do., C. A. Henderson, Brockville, $4.
Best Cassimere Cloth, from merino wool, one piece, J. N. Pitts, Port Dover, $6; 2nd do., Platt Hinman, Grafton, $4.
Best Cloth, fulled, one piece, B. M. Clark, Ernestown, $6; 2nd do., R. Williams, Switzerville, $4.
Best Counterpanes, two, Mrs. A. J. Waldron, Storrington, $5; 2nd do., Miss Catharine Harker, Kingston, $3.
Best Check for Horse Collars, one piece, N. Leonard, Westbrooke, $4; 2nd do., C. A. Henderson, Brockville, $3.
Best Drawers, factory made, woollen, one pair, T. Wilson, Kingston, $4.
Best Flannel, factory made, one piece, Hiram Tubbs, Hallowell, $5.
Best Flannel, not factory made, one piece, D. Campbell, Charlottenburg, $5; 2nd do., W. Tubbs, Picton, $3.
Best Fur Cap and Gloves, C. Wright, Kingston, $4; 2nd do., Groh & Meyer, Kingston, $3.
Best Fur Sleigh Robes, buffalo, wolf and racoon, an assortment, J. A. McDowell, Kingston, $5; 2nd do., C. Wright, Kingston, $3.
Best Gloves and Mits of any Leather, an assortment, J. Dewitt, Montreal, $4; 2nd do., Groh & Meyer, Mingston, $3.
Best Horse Blankets, two pair, Robert Dennison, Napanee, $5; 2nd do, W. S. Guess, Loughboro, $3.
Best Kersey for Horse Clothing, one piece, N. Leonard, Westbrook, $5; 2nd do., R. Dennison, Richmond, $3.
Best Linen Goods, one piece, Daniel Campbell, Charlottenburg, $5; 2nd do., Daniel Campbell, Charlottenburg, $3.
Best Overcoat of Canadian Cloth, John Kinnear, Kingston, $4; 2nd do., Joseph Brown, Camden, $3.
Best Satinet, black, one piece, R. Williams, Switzerville, $6.
Best Satinet, mixed, one piece, R. Williams, Switzerville, $5.
Best Silk and Felt Hats, Clark Wright, Kingston, $5; 2nd do., D. Chisachi, Kingston, $3.
Best Suit of Clothes, of Canadian cloth, J. Kinnear, Kingston, $8.
Best Tweed, winter, one piece, John Pitts, Port Dover, $6.
Best Tweed, summer, one piece, J. N Pitts, Port Dover $6.

Best Woollen Cloths, Tweeds, &c., an assortment, J. N. Pitts, Port Dover, $10.

Best Woollen Shawls, Stockings, Drawers, Shirts and Mits, an assortment, E. Snider, Elizabethtown, $10.

Best Yarn, white and dyed, one pound of each, Thos. Wilson, Kingston, $2; 2nd do., E. Jackson, Kingston, $1.

Best Yarn, fleecy woollen, for knitting, one pound, Mrs. T. Wilson, Kingston, $2; 2nd do., Mrs. Chas. Bellwood, Clark, $1.

Best Yarn, cotton, two pounds, D. Campbell, Charlottenbnrg, Glengarry, $2.

Extra Entries.

Rag Carpeting, N. Dollar, Fredericksburg, $3; Assortment of Furs, Mocassins, &c., Jas. McDowell, Kingston, $5; do., do., Clark Wright, Kingston, $5; Linen Drapery, D. Campbell, Charlottenburg, $5; Assortment of Dressed Furs and Ladies' Furs, Groh & Meyer, Kingston, $12; Flannels, Mrs. L. Brown, Camden, $3; Ladies' and Gentlemen's Furs, D. Chisachi, Kingston, $8; Fancy Carriage Robe, Mrs. T. Wilson, Kingston, $3; Gentleman's Plaid, D. Campbell, Glengarry, $1; Suit of Persian Lamb Skin Fur, J. McDowell, Kingston, highly commended, $4.

CLASS LIV.—FOREIGN MANUFACTURES—(20 Entries.)

Judges.—J. E. Pell, Montreal; and W. H. Sheppard, Toronto.

Family Sewing Machine, C. W. Williams & Co., Boston, commended.

Stonepaper for Roofing, manufactured in Prussia, W. Wagner, Montreal, Diploma.

Cottage Organ, Jacob Esta, Vermont, Harmonic Organ, do., do., Double Harmonic Melodeon, do., do., Single do., do., Harmonic Aeolian, do., do., Square Piano, do., do., all exhibited by D. W. Caldwell, agent, Kingston, highly commended, Diploma.

Illuminated Book-marks, woven in silk, Thomas Stevens, Coventry, England, commended.

Cutlery, Button & Milliner, Rochester, Diploma.

Assortment of Flint Glass, E. D. Dethridge, Pittsburg, commended.

Sewing Machine, G. W. Folts, Toronto, commended.

One 7-octavo Piano, Stodart & Morris, New York, exhibited by B. A. McDonald, agent, Toronto, Diploma.

Publications of the British & Foreign Bible Society, exhibited by E. Stacy, agent, Kingston, commended.

Board of Arts and Manufactures

FOR UPPER CANADA.

THE JOURNAL FOR 1864.

At the commencement of the present volume of this Journal, the Executive Committee of the Board lowered the annual subscription to the uniform rate of 50 cents per annum to members of Mechanics' Institutes and the public at large. This diminution was made under the expectation that subscribers would severally remit the small sum of fifty cents, and thus save the Board the expense of a collector. In consequence however of this reasonable expectation of the Board not having been fulfilled they are compelled to raise the annual subscription to seventy five cents, which will enable them to employ not only a collector but also a Canvasser, by which means it is hoped the circulation of the journal will be increased to such an extent as nearly to pay the expense of the publication. The increased monthly issue will be raised to 2000 copies, which will furnish an excellent means of advertising to business men of all classes, whether mechanics or otherwise.

BRITISH NEW PUBLICATIONS FOR OCTOBER.

Animals: their Food and Instincts, new edit., 16mo	0	1	6	*Jackson & Wal.*
Field (Geo.) Chromotography: a Treatise on Colors and Pigments, new edit., 8vo	0	8	6	*Winsor & N.*
Graham (Alex. J. S.) Manual on Earthwork, 18mo	0	2	6	*Lockwood.*
Grindon (Leo. H.) Life; its Natures, Varieties and Phenomena, 3rd edit., 8vo	0	6	6	*Pitman.*
Horton (Rich.) Table showing the Solidity of Hewn or Eight Sided Timber, cr. 8vo.	0	2	6	*Weale.*
Humphreys (Hen. N.) Coinage of the British Empire, new edit., roy. 8vo	1	1	0	*Griffin.*
Johnston (Jas. F. W.) Elements of Agricultural Chemistry and Geology, 8 ed., fc. 8vo	0	6	6	*Blackwoods.*
Kirkes (Wm. Senhouse) Handbook of Physiology, 5th edit. revised, post 8vo	0	12	6	*Walton.*
Lowdes (W. T.) Bibliographer's Manual of English Literature, by H. G. Bohn, pt. 9, post 8vo	0	2	6	*Bohn.*
Lynn (Wm. T.) Principles of Natural Philosophy, fcap. 8vo	0	3	6	*Van Voorst.*
M'Nicoll (David H.) Dictionary of Natural History Terms, post 8vo	0	12	6	*L. Reeve.*
Main (Rev. Robert) Practical and Spherical Astronomy, 8vo	0	14	0	*Bell & Daldy.*
Merrett (H. S.) Land and Engineering Surveying, Levelling, &c., roy. 8vo	0	16	0	*Spon.*
Murray (Andrew) Book of the Royal Horticultural Society, 4to	1	11	6	*Bradbury.*
O'Gorman (Daniel) Intuitive Calculations, 23rd edit. revised, cr. 8vo	0	3	6	*Lockwood.*
Oil and Colorman (The) and Painter's Manual, 1863, 8vo	0	3	6	*Longman.*
Richardson (Thos.) and Watt (Hen.) Chemical Technology, 2nd ed., V. 1, p. 3, 8vo.	1	11	0	*Bailliere.*
Thompson (Peter) Oil and Colorman, 8vo	0	3	6	*Longman.*

British Patents.

ABRIDGED SPECIFICATIONS OF BRITISH PATENTS.

719. W. Symington. *Improvements in the process and apparatus used in roasting and treating coffee and other organic substances.* Dated March 17, 1863.

The patentee claims the method of saving and utilizing the aroma, volatile oil, and other products evolved during the process of roasting coffee, cocoa chicory, and other organic substances, by combining the cylinder or vessel in which they are roasted with one or more receivers or vessels containing cold roasted coffee, or nibbed or dried chicory, or other suitable substance, either powdered or otherwise, and in a disiccated or dried state, by which the aroma or volatile oil is absorbed and rendered valuable.

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732. A. Morel. *Improvements in apparatus for generating carbonic acid.* Dated March 18, 1863.

Carbonic acid gas may easily be produced by pouring an acid on a carbonate, such as marble, chalk, or bi-carbonate of soda; and this very facility of production creates variations of pressure in the generator, which requires continual attention, as also a gas holder for containing the gas. This invention relates to an improved generator of carbonic acid which is self-supplying, and regulates itself at a constant pressure without any supervision, and producing a regular current of gas without the aid of a large gas-holder or regulator.

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735. E. Lever. *An improved composition for the coating and preservation of canvas and other materials to make them waterproof and non-inflammable.* Dated March 19, 1863.

This consists of a composition or compound of about 5 parts quick lime, 3 parts glue, 3 part, whiting, 3 parts gum arabic, 1 part Epsom salts and 4 parts alum, dissolved in a sufficient quantity of water to make it of a proper consistency for the purpose required, or the material to be operated upon.

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779. J. H. Warrall. *Certain improvements in the method of producing surfaces in imitation of woods and in printing therefrom.* Dated March 25, 1863.

This invention is designed for the purpose of obtaining fac-simile impressions or representations of woods, by so treating the surface of the wood as to render the natural grain thereof available for transferring or imprinting the pattern upon paper or other material, the pattern so produced being applicable to imitation graining, paper-hangings, oil-cloths, figuring and embossing leather and textile fabrics, and to other ornamental purposes. The improvements consist in an improved method of obtaining such impressions from the natural surfaces of woods on paper, copper, zinc, or stone, and in transferring the patterns therefrom, and printing them upon surface such as paint, wood, stone, metallic surfaces, or textile fabrics, so as to represent the natural grain or appearance of the wood.

824. E. T. Hughes. *An improved composition for rendering cloth, paper, and similar articles transparent and waterproof.* (A communication.) Dated March 31, 1863.

This composition is composed of one part by measure of linseed oil, one part by measure of india-rubber cement, and six parts by measure of benzine. This for most purposes constitutes probably the best mixture; but for a preparation of tracing cloth and tracing paper of close texture it may be advisable to use an additional proportion of benzine, to avoid producing a gloss on the outside, and also to avoid filling the pores of the paper too full to retain the ink and colours which may be applied.

Correspondence.

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

Sir,—In some two months from the date of your present number of the *Journal*, the Legislature of our Province will, in all probability, be again called together, and the several measures referred to in his Excellency's opening speech of last session, but not yet proceeded with, will no doubt be taken up.

One of the measures indicated is an amended bill for the *Encouragement of Agriculture, Arts, and Manufactures.* This bill has been introduced during three several meetings of the Legislature, and on one occasion passed three readings in the Lower House and two in the Upper, but owing to the very diverse views held on the proposed amendments, and from other causes, its advocates have not yet been able to carry it through.

With your leave, Mr. Editor, I beg to suggest some necessary provisions in regard to the various exhibitions, and the organizations under which they are held. The absence of any recognised system or unity of purpose in holding these exhibitions must be apparent to any one who has paid the least attention to the subject. In passing the act now in force, and making provision for the organization and liberal subsidation of township, county, and provincial associations, and the holding of periodical exhibitions, the Legislature undoubtedly intended that they should all work as an harmonious whole—the township exhibitions being subsidiary to those of the county, and the county exhibitions subsidiary to the provincial, and all held at such periods as would allow of the scheme being carried out without clashing of interests of the various societies.

According to present practice some of the county societies hold their exhibitions prior to the provincial, and some after; the counties and townships acting in the same disregard to order—throwing their prizes open to competition for the whole Province, and constituting each one a miniature provincial exhibition, instead of confining the privilege of competing to actual residents of the county or township in which the respective exhibitions are held.

What I would suggest is, that all the township societies should hold their fall shows during the second week of September, that the county societies should hold their exhibitions during the third week of September, and that the provincial exhibition should be held during the fourth or last week of September, or the first week in October; and that these dates or periods should be fixed by the Legislature and form a part of the Act—a departure from which by any society should incur a forfeiture of their legislative grant for that year. I would also make it a provision of the Act, that each of the township and county societies should restrict the right of competing for its prizes to the actual residents or occupiers of land within their respective societies' limits, so that their exhibitions should constitute fair expositions of the agricultural and manufacturing products and skill of each township and county in which they are held.

A growing desire is being manifested by local societies for uniting to hold *Grand Union Exhibitions*, throwing their prizes open to competition to the WHOLE PROVINCE, and creating a rivalry between themselves and the Provincial Association. This should be prevented by public enactment. The public money is not given for such a purpose. The township societies holding their exhibitions first, should select their best specimens in every department to represent their townships at the county shows; the counties should afterwards hold their shows, selecting the best specimens for prizes, and endeavouring to secure their exhibition at the succeeding provincial show. Better that no county or township shows be held, than that they take place after the provincial exhibition with their prizes thrown open to all on the same conditions as provincial exhibition prizes. If we are to have local shows, let the townships be feeders to the counties, and the counties to the provincial; and so as to limit the number of shows—which are now altogether too numerous for the good of either the agriculturist or manufacturer—let the Riding and city electoral division societies be done away with, and but one society be constituted in each county—the public grants of money to such societies to be in proportion to the number of townships and the population each contain; incorporated horticultural societies in cities and towns participating in such public grants and standing in the same relation as townships to the county societies.

The various associations here proposed to be dealt with, have, by their exhibitions, been the means of effecting vast improvements in almost every department of our provincial industry, and too much credit cannot be given them for it, but there is reason to fear that, owing to local jealousies, and the sanction of the present law, petty exhibitions are becoming quite too numerous, and an immense amount of money is squandered, with but little good result, compared with what might be the case under a better and more uniform system of management.

I understand, Mr. Editor, that all the members of the Legislature are considered readers of your *very valuable* Journal; I trust, therefore, that some more able correspondent than myself will make it the medium for bringing this very important subject under their notice, and that of the honorable Minister of Agriculture, so that they may have time to give it due consideration ere they legislate upon the bill during the next session of parliament.

Yours, very respectfully,

Toronto, Dec., 1863. W.

Selected Articles.

THE BEARINGS OF SHAFTS.

So little attention is given to this subject by persons who ought to know better, and so much indifference is manifested to the results of neglect, that we have felt it important to call attention to the subject and by pointing out the causes of disaster, bring the matter to the direct attention of all interested. Many steam engines have been disabled, and the safety of the passengers and cargo imperilled when on ship-board by inattention to the condition of the bearings. We have ourselves seen a large beam engine slowed down and finally stopped entirely from the cause alluded to; so hot had the beam centre (the part injured) become, that the utmost efforts of powerful men and a large sledge weighing some twenty pounds were unavailing to slack off the nuts which held the "binder" down; as for unscrewing the nuts in the legitimate way—with a wrench—that was out of the question; a three-fold block and luff tackle would hardly have started them. In the case alluded to, the diameter of the centre was perhaps 14 inches by about 20 inches in length, and although for thirty minutes previous to the disaster everything was working properly, so rapidly did the bearing heat up that, if unattended to longer, it would probably have split the pillow block, there being no other possible outlet for the expansion. We have cited this case as one showing the importance of close surveillance to the detail in question, for not only is valuable time lost but the machines themselves are greatly injured, sometimes involving costly repairs. In turning up shafts and bearings we have observed a reprehensible practice in some shops and that is the use of the file. No good turner would employ such a tool to finish work that ought to be done by the cutter. The tendency of filing is to produce irregularity, and when the work is heavy and the speed slow, the use of the file is the height of absurdity and ought not to be permitted by any foreman.

The beautiful glaze produced by a sharp turning tool is as nearly akin to the working surface made on shafts by long running as any new journal can be, and consequently a well turned bearing is much less likely to heat and cause trouble than a filed one. When new shafts heat at the outset, a little time and patience will in general suffice to bring them down to their work, and in all cases it has been found the best practice in this country, to bore the brasses from a sixteenth to an eighth of an inch larger, according to the diameter of the shaft, so that the journals may bottom fairly and not touch the sides at all. When shafts are "side bound" they will invariably heat, because in addition to the peculiar rolling friction of the work there is added the weight of the metal, which in shafts of 15 and 20 tuns is an important item Of course weight is present in any case, but in a well fitted bearing it is dead, and not *wedging weight* so to speak, such as exists in brasses which fit tightly to the sides of shafts. In our best machine shops files are virtually discarded in fitting large brasses to bearings; as in addition to their awkwardness, there is the expense of them to be considered; besides this the peculiar harsh surface they leave is not favourable to a cool bearing. The scraper is substituted with good results, both of time and execution, as when well done the scraped brass is perfectly mirror-like, and is reduced to a working surface in a short time. Shafts may be well turned and properly fitted to their places and yet heat beyond all control; this evil can sometimes be remedied by applying *medicine* to the shaft with the oil, in the shape of black lead sulphur, and in cases of great immergency, common quicksilver; this last substance is most excellent for curing journals that have been cut of the peculiar rough surface they acquire, as it produces a kind of greasy gloss that for a short time covers up the neglect or misfortune of the engineer. Where all other measures fail the brass itself must be taken out and its composition changed; either it is too hard or too soft for the journal. We have known of a chronic hot bearing being cured in this way, after a great deal of time and labour had been expended in keeping it in running order; even to the extent of playing upon it with an inch hose throughout the trip. In the navy all the journal boxes on the new gunboats are hollow and fitted with pipes through which a stream of water passes continually. Some merchant ships are also thus fitted.

It is a curious fact in connection with bearings that they will occasionally defy all the efforts of experience and science to reduce them to obedience after they once heat thoroughly. It is possible that this effect may be traced to a want of proportion between the size and the labour on the shaft; but of two bearings both precisely similar (in fact on the same shaft, we have found that the one which had the most duty to perform behaved the best. This is of course an unusual case, and is merely cited as an example of the previous remarks. When shafts set in brass boxes heat, they merely cut the shaft or the box, but when Babbitt metal is used, heating causes mischief that can only be repaired by overhauling. One peculiar effect of white metal is to reduce iron journals much more rapidly than brass; where brass boxes are lined with Babbitt metal, as is often the case, the iron journal will be found very much worn down where the white metal comes in contact with it, while the brass shell of the box is but slightly thinner than it was originally. This is owing to the peculiar toughness of the white metal; where journals are run in this substance and well lubricated, they acquire a perfect surface in a short time that very much lessens the friction of an engine or other machine. We have seen large engines "turned over the centre" when the steam gage did not show a pound of steam; this is not wholly owing as many suppose, to extreme delicacy of workmanship and tightness of the working parts, but to the vacuum produced in the cylinder by the almost infinitessimal portion of vapour admitted to it; and although the steam guage may not indicate any tention whatever, there is a certain amount in the boiler which is transmitted to the cylinder, or else the machinery could not be moved. This is a little digression from the subject of bearings, but is in a measure connected with it; for while we stated a few lines back that free movement was not entirely dependent on easy bearings, we must admit that a stiffly connected engine will not turn the centres readily; where the resistance amounts to more than the vacuum is able to overcome, of course the engine must stand still.

A great many engineers seem to think that slacking off a hot bearing will cool it, independently of other considerations; this is not always the case. Too much friction is of course a source of derangement, but excessive freedom is also a fruitful cause of hot bearings; this may be accounted for by the theory that the oil is pounded out by the journal in jumping up and down, and it thus comes in contract with the naked metal; the fact remains true whatever be the reason assigned. Good lubricants, care and cleanliness, will generally result in handsome bearings; no one will question that a large amount of power is absorbed by a rough bearing, or one half oiled. Stop up the oil holes, and if the collars have much play back forth, arrange leather shields to cover the space; keep dirt out and oil in, and much better results will be obtained than where carelessness is practiced and filth allowed to accumulate.

MANUFACTURE OF PARAFFINE IN SCOTLAND.

The London *Ironmonger* contains a communication (which we condense) on the manufacture of paraffine, at Bathgate, Scotland, the most extensive of the kind in the world. The works were established by James Young, the patentee of the process for manufacturing oil for commercial purposes from coal, and to whose success we are indebted for the introduction of coal oil, and petroleum—the latter being purified for use by the coal oil process. Bathgate is situated on the field of the celebrated Boghead coal—a rich cannel—and was commenced about twelve years ago, upon a very small scale; but since then it has developed with an immense charcoal establishment, the works covering an area of twenty-five acres of ground, and giving employment to 600 men. The coal used is first broken into small pieces by a machine like an anthracite coal crusher, and is then ready for the retorts. These are arranged vertically in sets of four, each being eleven feet in height, and the coal is raised to a platform near their top. Their upper ends, which project above the platform, are each closed by a conical hopper; the opening of the hopper into the retort is closed by a spherical valve, which is suspended in the retort and pulled up against the opening by a chain worked by a counterpoise. This simple contrivance is rendered sufficiently air-tight by a handful of sand being thrown into the hopper. When it is wished to re-charge the retort, the workman fills the hopper with the broken coal, and then depressing the iron chain, lowers the spherical valve, when the contents of the hopper fall into the retort, the opening being immediately closed again and luted by a fresh handful of sand. From the construction of the retort, the coal is gradually heated as it descends to that part of it which passes through the furnace.

The bottoms of the upright retorts pass completely through the furnaces, and are closed below by dipping into shallow pools of water, that form air-tight joints. The advantage of this arrangement is evident; the spent coal from which the oil has been driven off, as it passes through the hot part of the retort gradually descends into the water, and is from time to time raked away below, the coal from above descending as it is removed. Thus the action of these retorts is continuous, and the distillation goes on uninterruptedly both night and day. The waste refuse or spent coal from the retorts consists of about one-half carbon, the remainder being mineral matter. As it is not well adapted for fuel nor utilized in any way, it accumulates in enormous mounds that cover several acres near the works. The vapours which are produced in the retorts are all conducted by iron tubes to the main condensers. These, like the ordinary condensers in coal-gas works consist of a series of iron syphon pipes freely exposed to the air. In passing through these pipes the vapours condense into liquid, a very inconsiderable portion escaping into a gas holder as incondensible gas.

In gas-works, a high temperature resolves the coal into incondensible gas and coal tar, the latter being a liquid heavier than water. In the Paraffine Works a comparatively low temperature, gradually applied, furnishes an inflammable oil lighter than water, with so small a portion of incondensible gas that practically it is of little consideration.

The crude oil produced in the numerous stacks of furnaces by the distillation of the Boghead coal is conveyed by means of iron pipes to a general reservoir: this is a brick tank sunk in the ground, and capable of containing 40,000 gallons. This crude oil is a mixture of various substances, some of which are very volatile, and give off inflammable vapors even at the ordinary temperature of the atmosphere. This tank is perfectly gas-tight, and is thus guarded against fire, while the refined oil is kept in circular iron tanks, each capable of holding 100,000 gallons, and sometimes one million of gallons are kept on the premises.

The crude oil as first obtained from the coal is a dark-coloured thick liquid, containing all the products of its distillation. The first process of purification it undergoes is simple distillation. This is performed in cylindrical iron stills of enormous size; in these it is distilled to dryness, the superabundant carbon that it contains being left in the form of a shining black coke. As it is necessary to clear out this coke after each distillation, the retorts are made to open at the ends, so as to admit of its removal. This coke is employed as fuel. The vapor arising from these stills is cooled by being conducted along iron pipes passing through large open tanks sunk in the ground. These tanks have a very small stream of water flowing through them.

When the first purification by simple distillation has been effected, the oil is further purified by being acted on by strong oil of vitriol, or sulphuric acid. The Bathgate Works include a complete apparatus for its manufacture: there are furnaces in which large quantities of sulphur are burned: vast leaden chambers, in which the fumes, mixed with those arising from aquafortis, are condensed into the liquid acid; and huge glass evaporating pans bedded in sand, in which the produce is concentrated by heat until it attains the required specific gravity of 1.848. In order to insure an adequate mixture of the paraffine oil and the sulphuric acid required to purify it, both are allowed to flow in the requisite proportions into circular tanks. Each of these contains a revolving stirrer, which throws the whole into great commotion, and causes the intimate mixture of the two liquids, spite of their different specific gravities, the acid being double the weight of the oil. This admixture is continued for about four hours, when the combined fluids assume a beautiful opaque green appearance. On being allowed to rest, the impurities which are charred and separated by the action of the oil of vitriol, subside to the bottom in the form of a dense, black, heavy acid tar. As this is not turned to any practical use, it is requisite to get rid of it in some way, as it cannot be allowed to pollute the neighboring streams, and its accumulation would be very inconvenient; it is necessary, therefore, to boil it to dryness, when the solid residue is used as fuel. In order to separate the remaining impurities and that portion of the sulphuric acid which is left in the paraffine oil, it is next subjected to the action of a strong solution of caustic soda. This chemical re-agent is also prepared at the works, a regular soda factory being in constant operation. This soda is rendered caustic by quicklime: and after having been used to purify the oil, is again worked up and re-used over and over again.

As thus purified, the oil contains four distinct commercial products, which require to be separated from each other in order that each should be made available for useful and economical purposes. To effect this separation, the oil is again distilled. The first elevation of temperature drives over the lighter and more volatile portions; these are collected separately, and when purified by a subsequent distillation, yield on condensation the fluid known as naptha. This naphtha differs essentially from that obtained from coal tar; the paraffine naptha having a specific gravity of ·750, whereas that procured from coal tar has a specific gravity of ·850. The paraffine naphtha is of great value as a substitute for turpentine. It is also largely used to those naptha lamps in which the fluid descends down a long pipe from an elevated reservoir, and being converted into vapor by passing through the heated burner, jets out into a star-like flame. These lamps, from not requiring a glass, nor being extinguished by a powerful current of air, are much employed by costermongers, and workmen in railway tunnels.

From its great volatility the naphtha does not require for its evaporation the heat of an open fire; it is therefore finally distilled in a separate house devoted to the purpose, the heat being furnished by the steam from a boiler situated outside the building. On the perfect separation of the lighter and more volatile naphtha depends the safety of the burning oil.

The burning or paraffine oil, which is the next product in point of volatility, comes over at a considerably higher temperature than the naphtha. The third product in point of volatility is the heavy oil used for lubricating. As originally obtained, the lubricating oil contains dissolved in it a very considerable proportion of solid paraffine.

In order to cause the cystallization of this paraffine from the heavy oils, a low temperature is requisite. As this occurs naturally only in winter, during the greater part of the year an artificial refrigerating apparatus became indispensable. Formerly a machine acting by means of either was employed; but that has been entirely superseded by a most beautiful refrigerating instrument invented by Mr. Kirk, the resident engineer of the works. By this contrivance the necessity of employing expensive volatile liquids is entirely obviated, their place being supplied by atmospheric air. It is difficult to say which is most to be admired—the theoretical perfection or the practical efficacy of this instrument. By the action of a piston working in an ordinary cylinder, a quantity of air is suddenly and forcibly compressed in a separate vessel. By this compression, the latent heat of the air is forced out, and its temperature instantaneously becomes very highly raised. The heat of the air, however, is rapidly abstracted by contact with the sides of the cavity, which are kept cold by a stream of water. The compressed air so cooled, is then passed to the other extremity of the containing vessel, and permitted to expand. In doing this it takes in an equal amount of heat to that which it had lost by condensation; and it abstracts this amount from the surrounding objects, cooling with great rapidity a stream of brine which flows through channels in the vessel. This stream of brine, which is much colder than freezing water, is employed to lower the temperature of the heavy oils, down to that point at which the paraffine crystallizes out. This refrigerating engine produces a cooling effect eqnivalent to two tuns of ice every twenty-four hours with a very small expenditure of fuel. The heavy oils containing the frozen paraffine are next put into bags when the oil drains away, leaving the solid paraffine. It is difficult to imagine any more beautiful substance than paraffine: in its liquid state it runs like water, looking brighter and more transparent than the neighboring trout-streams. In a solid form it is the most elegant of all the substances used for making candles; whilst in its illuminating power it surpasses even spermaceti itself—eighteen pounds and a half of paraffine candles giving the same amount of light as twenty-three pounds of sperm, twenty-six of wax, twenty-nine of composite, and thirty-six of ordinary tallow. A small piece of paraffine added to starch will be found to give a gloss and brilliancy of surface to the starched linnen that can be attained by no other addition. From the greater resistance of casks than of metallic vessels to accidental violence in transit, the former are obviously the best means of insuring its safe conveyance; but the diffusive power of the oil is so great that it readily penetrates through the joinings of the staves. This inconvenience has been met in a very ingenious manner; each cask receives a coating of glue internally; this renders it quite impervious to the oil, so that the casks when in the possession of the retailer may be stored without the loss and annoyance of leakage. The cooperage attached to the works is a large and extensive organization: not only are the casks made and glued, but there is a distinct department where those returned to the works are cleaned and re-glued; and there is even a machine for the purpose of scrubbing the exterior of each, so that on its re-issue it goes forth in a clean form that is not objectionable in any warehouse in which it may be located.—*Scientific American.*

ALUMINUM BRONZE.

The important part which the new metal aluminium, appears destined to play in the arts, chiefly as an alloy, forming with copper aluminum bronze, which, considered both in respect of its characteristics and its market value, will be esteemed by manufacturers as virtually a new metal.

When the French chemist, M. Deville, published, in 1854, an account of his experiments upon the preparation and properties of aluminium, great hopes were entertained that it might be produced at a sufficiently low price to admit of its receiving many practical applications, to which it seemed suitable on account of its remarkable qualities. A metal being but little more than one-third of the specific weight of copper, and considerably less than half that of the lightest of the commercial metals, zinc; unacted on by oxygen or sulphur, and but little affected by most acids; possessing at the same time tenacity, combined with ductility and having a moderately high melting point–might well be supposed *à priori* to be susceptible of many interesting and important uses. Up to the present time, however, these expectations concerning aluminium have not been realized. Although it is now produced on a considerable scale, the price remains too high* to permit of its being put to many uses to which it might be applied if it were a cheap metal; and its peculiarly dull colour is an impediment to its employment where beauty and brilliancy of appearance are desirable. Independently, however of its usefulness *per se*, there seems to be a wide field open for the application of aluminum in the form of alloys with the more ordinary metals, the properties of which are changed in a remarkable manner by its presence, even in small quantities. On the other hand very small quantities of the common metals destroy the ductility and malleability of aluminium itself—in some cases altering its colour, and, in others, rendering it as brittle as

* The present price in London is dearer than that of silver, being about 5s. per ounce.

glass; mixed however, with a certain proportion of copper, an alloy is produced which possesses the properties of a valuable metal, capable of applications not only very important in themselves but for which it seems difficult to find any other metal or metallic alloy equally suitable. This mixture of aluminium and copper is the alloy called aluminum bronze. The alloy seems to have been first made a few years ago by Dr. Percy. Many of our readers will remember the specimens which were placed in the International Exhibition by Messrs. Bell, of Newcastle; and a later exhibition of articles manufactured from this substance by Messrs. Mappin, of Regent Street, must have familiarised most persons with its fine general appearance. Beauty of external appearance, however, is but one quality of a metal, and although an all-important one, in certain respects, it is one without which, as in the instance of iron, the metal may possess the most valuable and interesting properties. Without beauty of surface, it is true that its applications must be limited to the useful; but in England, where the employment of metallic substances is so varied and so extensive mere beauty is a secondary consideration. In the case of aluminum bronze however, beauty of exterior and more sterling qualities are united In colour, this alloy resembles gold so closely, that it would be difficult by mere inspection to distinguish one from the other; but its mechanical quantities excel those of gold. It is composed of copper and about 10 per cent. of aluminium melted together, and remelted once or twice. It is stated that the most essential condition to success in producing the alloy is purity in the copper employed; the best copper for the purpose, although its price prevents it from being much used, being that deposited by galvanic action; the next best is from Lake Superior, which is very pure, and yields with aluminium, a very good alloy. The re-melting of the alloy is a matter of great importance. The first melting appears to produce intimate mechanical mixture, rather than chemical combination of the metals; as in the proportion of 10 of aluminum and 90 of copper, an alloy of a very brittle character is produced by the first melting; but renewed opportunity of uniting into a definite chemical compound being afforded by repeated melting a more uniform combination seems to take place, and a metal is produced free from brittleness, and having about the same degree of hardness as iron. The alloy containing rather less than 10 per cent. of aluminium, is said to possess the most uniform composition and the best degree of hardness; but it is not always an easy thing to produce this desirable uniformity of texture; as patches of extreme hardness sometimes occur, which resist the tools and are altogether unamenable to the action of the rollers. The alloy produced by this combination of copper and aluminum is very tenacious, malleable, rigid, light in weight, and possesses a fine golden colour. Its qualities being so various, we have to view it in two different characters, viz., as suitable to the manufacture of ornamental articles, to which it is adapted from the closeness of its resemblance to gold; and as capable of being applied, on account of its valuable mechanical properties, to useful purposes, to many of which it seems to be better fitted than any other metal or alloy.

With regard to the first, but what is really after all, the least important of its characters—that is, its adaptability to ornamental uses—the points to be considered are: colour, condition of surface, capability of receiving impressions from dies, or being worked and chased, and, lastly, insusceptability to the action of oxygen and sulphur. What is the situation of aluminum bronze with reference to these questions? In its application to ornamental purposes this alloy is, undoubtedly, a valuable addition to the resources of the artist, inasmuch as it affords him the means of imitating almost exactly the effect of gold, in a material very superior to the ordinary gold substitutes, homogeneous in texture and colour, and comporting itself with respect to external influences, more like silver than a cheap alloy. In sculptured and chased work, it presents a similar depth and richness of effect with gold, and in polished surfaces it is almost equally brilliant; while in cases where it was thought that the colour of the alloy does not afford a sufficiently close approach to the tint of pure yellow gold, it will probably, as a gilding metal, present the best possible foundation for a coating of fine gold.

In many respects therefore, the new alloy may be reasonably expected to play an important part in relation to ornamental work. It remains to examine its qualities with regard to important mechanical applications, and it is here that the valuable qualities of the alloy come out in the strongest manner. In respect to this part of the subject, the properties of the metal to be considered are its tenacity, malleability, power of resisting compression, rigidity, founding qualities, behaviour under the action of tools, and specific weight. With regard to most of these points, the aluminum alloy compares with great advantage with all other metals and alloys. In experiments made in the Royal Gun Factory at Woolwich, by Mr. Anderson upon the tensile strength of this metal, he found it to exceed that of the best gun metal in the ratio of 2 to 1; the aluminum bronze sustaining a strain of 73,185 lbs. to the square inch, the gun metal not more than 35,040 lbs.; whilst the tensile strength of the best cast steel is about 72,000 lbs. So with regard to the power of resisting compression it was found that a specimen of the alloy bore a crushing force of 132,000 lbs. per square inch, whilst there were no indications of compression until 20,384 lbs. per inch had been applied; the strength of the alloy under compression exceeding that of the best cast iron, which, may be taken at less than 120,000 lbs. The superiority of the metal extends likewise to the question of transverse strength or rigidity, wherein it surpasses gun metal in the ratio of 3 to 1, and brass in the ratio of 44 to 1. As a founding metal, it can be employed without difficulty, and it produces castings of any size, of the best character; whilst under the file, and in the lathe, it can be worked almost as easy and freely as gun metal. Although it can be rolled into sheets, it is said that it does not solder very readily nor strongly, and this might perhaps prove some impediment to its use in producing certain forms of work. But in every other respect, ordinary mechanical manipulation can be applied with the greatest success.

There is an important quality of the alloy not yet mentioned, that is its low specific gravity. The weight of the bronze, containing 10 per cent of aluminum, 7·68 a weight which corresponds very nearly with that of wrought iron; so that, taking into consideration the superior strength of the material, and the consequent smallness of parts necessary in an apparatus constructed from it, we perceive that, from the lowness of the specific gravity, the work would be extraordinarily light. Altogether, in a mechanical sense, this alloy seems to compare most closely with steel; and it is the opinion of competent persons, that in certain kinds of apparatus and instruments, the oxydizable steel may be well substituted by the comparatively unoxidizable aluminum alloy. It is probably in the construction of high-class philosophical apparatus, therefore, that the great value of this alloy will be found. In such work, combined strength and lightness are requisite, and these qualities are united in the highest degree in aluminum bronze. It can be engraved with great sharpness and regularity, and the engraved lines are said to be remarkably distinct. Writing on this subject, Lieut.-Col. Strange observes, that experiments, and the concurrent testimony of those who have given it a fair trial, prove that ten per cent. aluminum bronze is superior, not in one or some, but in every respect, to any metal hitherto used for the construction of philosophical apparatus.

The present price, about 6s. 6d. per lb., of the alloy, is no doubt an obstacle to its extended use. In cases where elaborate workmanship is required the price will, however, bear but a small proportion to the value of the work; and the important question, under such circumstances, is not the difference of a few shillings in the value of the raw material, but the existence of qualities in that material which will ensure the greatest possible effectiveness in the manufactured article.—*Newton's London Journal.*

INDUSTRIAL DISEASES.

Arsenical Green.

We learn from the report of Mr. Simons, the Medical Officer of the Privy Council. that work-people who have much to do with arsenical green are liable to suffer from its influence in two different ways—first almost universally they suffer, and in many cases very grievously, from peculiar skin affections, which the irritating arsenical dust of the occupation engenders; secondly, in many cases, the arsenic gets absorbed into the body, and produces, with more or less severity, the ordinary signs of chronic arsenical poisoning. These results do not fall with equal severity on all branches of the industry, nor on all industrial establishments; but both in different branches of occupation, and also in different establishments, proportion themselves to the intensity of the arsenical influence. It accordingly deserves particular notice that the occupations which have to do with arsenical green are pursued entirely without restriction by law. And the evidence now submitted with regard to occupations corroborates very importantly the general conclusion which an accumulation of other evidence led me to suggest in my last annual report, that in all industrial establishments which directly or indirectly endanger health, ought to be subject to official superintendence and regulation.

Sufferings from arsenical green arise much more during the application, than during the manufacture and packing, of the pigment. Indeed the *manufacture*, in the open air, does not seem to produce extreme ill-consequences. The arsenical dust, like all other dusts irritates the mucous membrane of the nose and eyes; presently it begins to affect the skin (especially at the arm-pits, and at the scrotum) producing itching, blotches, rawness, and perhaps boils; and these inconveniences, it seems, commonly, make the workman discontinue work before he has absorbed such a quantity of arsenic as would affect his internal organs and develop signs of true arsenical poisoning.

The *industrial applications* of the pigment are principally two:—first in the colouring of various papers, either of the sorts used for ornamental wrapping and lining, or of the sorts used for hanging in rooms; secondly, in the colouring of artificial leaves, fruits, and flowers. The pigment is also used, though less considerably, by chromolithographers and toy makers. It is likewise used by house painters. It is used as a colour for tarlatanes. And most culpably, though only to a small extent it is used by the makers of cake ornaments and coloured confectionary. So far as concerns the health of persons employed, only the first two occupations require particular notice; but, in them, there is a considerable suffering.

Thus, for instance, in visiting one of the larger establishments where artificial leaves are made, an establishment employing about one hundred young women, Dr. Guy found more or less suffering was almost universal among the work-people. The skin affection, which hardly any of them escaped, and which sometimes would begin after even so little as one day's working, occurred in different degrees: sometimes as mere erythema, sometimes as an eruption of clustered papules, vesicles, or pustiles, sometimes as more or less destruction of skin, by process of ulceration or sloughing, The fingers, which (often with accidental chops and scratches on them), are the immediate agents in the industry; the face, the neck, especially about the roots of the hair, the flexture of the arms, the axilla, the genitals; these were the parts where the skin-disease had most shown itself: parts namely, to which the arsenical dust is most largely applied, and parts where it is the most likely to be retained, and parts where the cutical is most thin and penetrable. The suffering from these skin affections had been, in many cases, very considerable; for instance, in several cases the mere pudendal affection had been such that the sufferers could not bear to sit down. But the skin affection was only a minor part of the suffering. Of twenty five of the sufferers whom Mr. Guy examined, nearly all showed signs, often highly developed, of chronic arsenical poisoning; excessive thirst, nausea, and loss of appetite, sickness and vomiting; often with pain in the stomach, palpitation, and shortness of breath, debility, fever, headache, drowsiness, dimness of sight, and tremblings, nervous twitchings or convulsions. Dr. Guy says: of the whole group of twenty-five females, four only did not complain of weakness; and of the remaining twenty-one there were again only four who did not describe the weakness as extreme. Febrile symptoms were present in no less than 20 cases, in five of which they amounted to feverishness, while in the remainder they were described as fever. Headache, again, was an almost universal symptom. It was absent in two cases only, and was described as not severe in only three cases. Dimness of sight was complained of in two-thirds of the cases. Drowsiness was present as a marked symptom in every instance but one, and in two cases was it spoken of as a trivial circumstance. Tremblings, and convulsive twitchings were present in seven cases out of the 25, and in one other instance, well marked convulsions were present." Wonder is expressed that out of such a group as this, deaths are not constantly occurring in a way to demand the coroner's investigation. Only one such investigation seems to have been made. The death which gave rise to it was certified by the coroner's jury to be "death by arsenite of copper." The victim, a girl of 19, whose case is told by Dr. Guy, had, for 18 months, without intermission, in spite of cruel sufferings, pursued her poisonous occupation. Her story during nearly all this time was but the common story of the workshop, only the same sort of story as Dr. Guy elicited from many of those whom he examined. During the whole of that time, Dr. Guy states, she had "suffered from eruptions about the neck, scalp, and hands, accompanied by pains in the nose, with the common symptoms of a cold, great pain in the left side, frequent vomiting of food, and intense thirst. She was first seen by Mr. Paul, the medical man who attended her, on the 15th November. She was in bed, breathing laboriously, and complaining chiefly of the pain in the side, and of frightful thirst. The countenance wore an expression of great anxiety, and the conjunctiva had a peculiar green tint. The pulse was about 120, and very small. The tongue was dry, brown down the centre, and green on each side. The vomited matter was quite green, but the discharges from the bowels had a natural colour. There was little diprrhœa. The skin was very hot.

The abdominal parieties were drawn back, but the abdomen was not painful except just over the stomach. There was a slight cough, but no expectoration. On the following day, she still complained of thirst, pain and her pulse was 130. At the evening visit, the breathings had become much more laborious, and the pupils were dilated. On the 17th, the pulse was of the same character, but increased in frequency. The vomiting continued till the evening, when she still complained of the pain, which was worse. On the 18th she was seen to be sinking fast. She had twitchings of the left side of the mouth, and was scarcely able to speak, but she said that everything she looked at was green. The pulse had risen to 140. During the night of Nov. 20th she became insensible, and died at 11 a. m.

Although every one knows that the so-called *emerald green* is an admirable pigment, not every one knows and remembers that *emerald green* is a virulently poisonous compound of arsenic, and hence it comes that the pigment is extensively employed in ways which are utterly improper for so dangerous an article. Materials coloured by it are seen in many directions where the public, if duly informed, could scarcely consent to tolerate the danger, not only on a comparatively small scale in the lining of boxes, the painting of children's toys, the wrapping and ornamentation of confectionary itself, but also, and copiously, in the paper hangings of rooms and in the wreaths and tarlatanes of ball dress.

Dr. Guy's reports contain illustrations of the mischief which every now and then arises from one or other of these objectionable uses of the pigment.

Mr. Simons observes the restrictions under which this injurious and perhaps not indispensible branch of industry ought alone to be carried on are; First as a cardinal rule (the enforcement of which would make it the interest of each establishment to enforce various improvements in detail), the employment of any person while presenting even in the slighest degree, any sign of general arsenical poisoning should be absolutely prohibited. Secondly, by scrupulous cleanliness of the workplace and workers by ventilation of the work-place, and, when necessary, by special apparatus. The best known means should be used to prevent the diffusion of arsenical dust in the common atmosphere of the work-place, and to reduce the workers to receive the dust upon their hands.

The dangers to which the general public is exposed by the various ulterior uses of emerald green cannot, for the most part, be adequately guarded against, except by better public knowledge on the subject. It would be desirable, however, that the use of it by confectioners, either for confectionary, itself or for any wrapping or ornament of confectionary, should be punishable by summary proceeding. And it would also be desirable that the sale of emerald green, and of objects coloured with it, should be subject either to the same rules as govern the sale of white arsenic, or, at least, to such rules as would ensure the purchasers being fully informed that the commodity which he purchases is POISONOUS.—*Sanitary Reporter.*

THE MONT CENIS TUNNEL.

The greatest obstacle which the civil engineer can by possibility encounter in the formation of a line of railway, is a great mountain chain. Rivers, however wide, can be spanned in detail by a series of bridges springing from pier to pier; valleys, if not too deep and wide to render the construction of an embankment desirable, can be traversed by viaducts on the same principles; mountains, however, permit the passage of a railway only under the conditions of a succession of steep inclines, or by the tedious and expensive process of tunneling. Both means have been resorted to; and the elevated chains of both hemispheres afford us examples of the most magnificent engineering works which have ever been proposed or accomplished. In a recent number, we discussed at some length the means adopted for carrying the Great Indian Peninsular Railway across the Syahadree Hills, up the Bhore Ghaut. There we have an example of the incline system carried almost to its greatest limit. In the Mont Cenis Tunnel, we find nearly similar difficulties overcome on a totally different principle; while the magnitude of the works involved, and the means adopted for conducting them to a successful conclusion, render the undertaking one of the most remarkable in the history of engineering.

The Mont Cenis Tunnel is intended to connect Savoy with Piedmont; and in the district chosen for the future railway, the chain of the Alps extends about due east and west between two nearly parallel valleys. According to the plan which has been adopted, the northern entrance will be below Modane, about 18 miles west of Mont Cenis. On the south side the railway will emerge near the Alpine village of Bardonnêche, at a level considerably higher than the Modane entrance. Beyond the preliminary surveys required to lay out the line, nothing has yet been done towards the construction of the 25 miles of railway over an extremely difficult line of country, required to connect Bardonnêche with Susa; and we cannot consider the decision of deferring for the present the commencement of this portion of the line, as other than prudent, as it permits the concentration of the energies of all connected with the undertaking, on the vastly more important work of the tunnel. The greatest recommendation to the line from Bardonnêche to Modane, lies in the fact that it is much shorter than any other suggested for traversing the Alps between Savoy and Piedmont.

The lowest pass of this chain on the Italian side is about 2,100 metres (a metre is 39.37 in., or a little over 3¼ feet) above the sea level; and the tunnel will enable the railway trains to cross the mountain at a height of about 1,333·8—*i.e.*, 766·2 metres below the present pass. Its southern opening at Bardonnêche, in the valley of Susa, is 1,335·38 metres above the sea level; from this point it rises 0.5 per 1,000 metres up to a distance of 6,100 metres—that is, to about the middle of the gallery, when it again slopes down at a declivity of 22.2 per 1,000 to its northern opening near Modane in Maurienne, which lies at a height of 1,202.82 metres above the sea: so that the actual difference of level between the two extremities is about 320 ft.; the Italian end being so much the highest. The steepest gradient within the tunnel equals about 1 in 45, rising to the middle from the French side, descending then towards the Italian extremity, at the rate of 1 in 2000. One-half the tunnel thus having a stiff gradient, while the remainder is, practically speaking, a level.

When we consider that the total distance to be excavated through hard rock is about 7⅝ miles, at such a depth that the sinking of shafts is impossible, the magnitude of the difficulties to be surmounted may be realized. Under the first idea, that manual labour alone, employed at each end was available; the termination of the work could not be calculated on under twenty-five years; hence its promoters, reflecting on the vast annual outlay, necessarily extending over that period, so brought their influence to bear on the French Government, that they succeeded in procuring a convention—not, however, until last year—with France, by the virtue of which the latter State undertook to pay the sum necessary for the construction of 6,110 metres of the tunnel—half its length—at the rate of 3,000f. per metre, or 3,000,000f. per kilometre, on condition that this compensation should not, taken altogether, exceed 19,000,000f., reckoning the work upon the understanding that it should be executed by ordinary means, and allowing a period of twenty-five years, as necessary for its completion; but they stipulated that, in the event of the tunnel being accomplished in less than twenty-five years beginning with the 1st of Janurry, 1862, the capital of 19,000,000f. would be increased at the rate of 500,000f. for every entire year that might be deducted from the maximum of twenty-five years. If the works were to last less than fifteen years, the premium would be raised to 600,000f. for every entire year's reduction; so that, if the work were actually achieved in twelve and a-half years, the Italians would gain a premium of more than 16,000,000f. Moreover, as the French Government does not reimburse the Italians immediately, but pays the interest of the sums due, and these interests may be reckoned at 6,500,000f., France will, at the end of the work, be indebted to Italy to the amount of about 31,700,000f.

The tunnel was begun in 1857, with ordinary means. But that year and the two following were spent chiefly in preliminary operations, such as the construction of houses, workshops, &c., and up to the end of the year 1860 not much over 800 yards had been executed. The extremely slow progress of the works, by mere manual labour, stimulated the ingenuity of the engineers employed in their execution, MM. Grandis, Grattoni, and Sommeillier, who had already tried a boring machine designed by an English engineer, Mr. Bartlett, without success. Mr. Bartlett's contrivance was wrought by steam, and could not be applied to a tunnel where air could not be had for combustion. The Italian engineers proposed to substitute compressed air instead of steam; and, notwithstanding long opposition on the part of foreign scientific men, their method is now in full operation, and exceeds in success the most sanguine expectations. At the Bardonnêche end of the tunnel these gentleman have availed themselves of a fall of water about 86 ft. high to force air to a pressure of about 90 lbs. on the square inch, within wrought-iron cylindrical egg-ended receivers.

The machinery employed for this purpose is extremely simple, the principle involved being very similar to that of the hydraulic ram. The compressed air, is conveyed from the receivers by a cast-iron main, about a foot in diameter, to the face of the working, where it puts the boring apparatus in action. This machine, nearly 8 ft. high and 10 ft. wide, occupies the drift-way, or heading, which precedes the finished tunnel, enlarged from the heading by manual labour. Eight or ten jumpers are put in motion by suitable pistons, reciprocating within cylinders, which admit of such a motion from time to time as will expose every portion of the rock face to the action of the jumpers. Varying with the hardness of the rock, the average time required by the machine for boring a hole 32 in. deep is rather less than an hour. As soon as about 80 holes have been bored into the rock the machine is disconnected from the main tube conveying the compressed air, and is then withdrawn on rails to a distance of 80 or 100 yards, behind massive wooden folding doors, designed to protect the machine and the workmen from the effects of the explosion. Miners then enter the gallery and charge the holes with powder, light the fuses, and then retire behind the doors, which are closed. After the explosion, another gang of workmen enter the gallery, and set to work to remove the rubbish in waggons running upon narrow rails laid beside the main track, and in about six hours the way is clear for the return of the machine with a fresh gang of workmen, when the same series of operations is commenced, the work being continued day and night with but rare and short intervals of repose. The rock is a metamorphic schist of variable composition, but apparently all belonging to the carboniferous series, for the most part extremely hard, and especially difficult to work in parts where it is traversed by veins of quartz, that very quickly destroy the steel points of the jumpers. Fortunately, the rock is so close that it effectually prevents the entrance of water in excess; no more having been hitherto encountered, than just suffices to keep the jumpers properly wet; the water being introduced into the holes in extremely fine jets under the action of the compressed air. The machine at the Modane face of the working is supplied with air by a regular pumping apparatus put in motion by a large wheel driven by the waters of the Arc, the torrent which was at first employed to drive a machine similar to that at the Bardonnéche end, frequently failing in its supply. The air, after putting the pistons in motion, by escaping within the tunnel serves to ventilate it in the most perfect manner. Gas is introduced at the sides of the working; good light and ample ventilation securing the comfort of the labourers, and consequently the rapid advance of the works. The total estimated quantity of rock to be excavated is 600,000 cubic metres, or about 784,666 cubic yards. As the tunnel is 13,351 yards long, this will give for the lineal yard forward, and for the whole face of the tunnel to be removed, nearly 58 cubic yards. At the average advance of 1·17 metre per day, which the engineers calculate on from the progress already made, this will give a daily removal of 73½ yards cube; and if both faces are worked at the same progressive rate, it will yield 147 cubic yards of daily excavation for the joint work of all the boring machines in operation, and at this rate of working it will require about 14¾ years to complete the excavation. Many particulars respecting the tunnel have been laid before the Italian Parliament by General Menabrea, Minister of Public Works, from which we select the following, which will give at least a good idea of the importance of the undertaking and the progress already made:—"In 1862, in order to pierce 380 metres of the side of Bardonnéche, the men were employed 582 times, each time 7 hrs. 39 min., for boring, and 6 hrs. 2 min. for loading and exploding the mines and clearing away the rubbish. In these 582 operations, 45,751 holes were bored, from 75 to 80 centimetres in depth; 72,538 chisels were set to work; there were 54,785 blasts, 18,622 kilogrammes of gunpowder were fired, 76,000 metres of match line were burnt, and 1,334,000 cubic metres of compressed air were consumed, equal to 8,004,000 cubic metres of atmospheric air. The workmen on the 1st of January, 1863, were 720 at Modane, and 900 at Bardonnéche—altogether, 1,620. The grants for the work were as follows: For 1857, 1,000,000f.; for 1858, 3,500,000f.; for 1859, 500,000f.; for 1860, 2,500,000f.; for 1861, 3,000,000f.; for 1862, 2,000,000f.; for 1863, 2,000,000f.; altogether, up to this day, 14,500,000f. The expense, up to the end of February, has risen to 13,182,603f. 18c., and the Minister has in hand 1,317,396f. 82c. He, therefore, thought that it would be necessary to apply to the Chamber for an additional grant of 500,000f., to enable him to finish 600 to 700 metres of tunnel, which were to be completed before the end of the present year."

Miscellaneous.

The Supply of Petroleum.

The changes which have recently taken place in the use of fluids for artificial light have been rapid and astounding. Only a few years ago whale and lard oils were the common agents for this purpose; then these were superseded in a great measure by that dangerous compound of alcohol and turpentine, called "burning fluid;" and, again, this agent was displaced by oil, called "kerosene," distilled from cannel coal. To produce this oil large distilleries were erected in various sections of Europe and the United States; but now it too has been superseded by petroleum—the natural product of wells situated in the valley of the Alleghany, Pensylvania. How this fluid is produced in nature's laboratory is still a subject of speculation, but respecting its nature and uses we are well informed. In most respects it is similar to the oil obtained from coal, but it has been supplied so profusely and at such low prices as to have completely annihilated the manufacture of kerosene. In the course of two short years, the petroleum trade has attained to gigantic proportions. In 1861, only a few hundred thousand gallons of it were exported; in 1862, about five millions of gallons; while during the past seven months of this year, ending with September, twenty-one millions of gallons had been exported. If to this we add the same quantity for the home supply, the yield of the American oil wells is no less than two hundred thousand gallons daily. This is a prodigious quantity, and yet we do not overrate the amount, as we have been informed from very reliable sources. It has become an important article of manufacture owing to the great number af refineries required for its purification, and besides this, it has been the means of creating a new commerce in the numerous railway trains, boats and ships that are engaged in carrying it from the wells to distant places. American petroleum has therefore become an article of great interest, not only to the vast number of persons in most countries who now use it, but to the proprietors of the oil wells, the owners of refineries, and all who are connected with it commercially. In view of the vast quantity which the oil wells have yielded, the question naturally arises—"will they not soon cease to furnish such supplies, and may not the petroleum trade fall down as rapidly as it has risen up?" Undoubtedly, the petroleum is becoming less in quantity, just in proportion to the amount that is taken away from the wells; but the extent of the supply is as yet unknown. We understand that there are indications of the wells ceasing to furnish supplies for but a limited period, and this has caused some trepidation among those who are deeply interested in the business. Thus the Oil City *Register* says:—"A short six or eighteen months has, with few exceptions, been the average lifetime of the flowing wells. The latter portion of their time of running is also marked by a decrease of at least three-fourths of their original flow." This historic evidence of the past is in some measure useful to form a conclusion as to the future of the oil wells.

Individual wells it appears yield supplies for a very limited period; but the sources of petroleum may be like those of coal fields, some of which are so extensive as to have furnished millions of tuns for centuries, by boring new mines to reach different portions of the fields. It is stated that the new wells in the valley of Oil Creek do not give out such quantities as those which were bored about eighteen months ago, but the number of wells is much greater and the aggregate yield of petroleum has not diminished. Nearly six hundred wells have been bored in the one narrow valley, which is not over eighty rods in width and only a few miles in length and the adjacent ravines bordering upon it have been neglected. As the space hitherto tapped to obtain the petroleum is exceedingly limited, there are no good grounds for concluding that the quantity now furnished may not be continued for many years to come. Similar wells to those which have been bored may be extended over a very extensive area, as petroleum has been found in pumping wells along the Alleghany and Ohio rivers for a distance of more than one hundred miles.—*Scientific American.*

Young's Paraffin and Paraffin Oil Works.

About fifteen or sixteen years since, a thick dirty-looking oily fluid was observed flowing from the cracks in the sandstone roof of a coal-mine at Alfreton, Derbyshire. The attention of Mr. James Young was directed to the circumstance by Dr. Lyon Playfair, and he made a number of experiments with a view of utilising this liquid. These experiments resulted in the establishment of a factory for the production of lubricating and burning oils. After a short period, however, the supply failed, and the manufacture necessarily came to an end. This untoward termination led Mr. Young to reflect on the causes which had produced this natural petroleum, and to endeavour to ascertain whether it could not be obtained artificially. From its situation in the sandstone above the coal, Mr. Young was led to the conclusion that its production was dependent on the natural distillation of the coal by subterranean heat; and on investigation he found that by distilling coal at a low temperature, he obtained an oily liquid in large quantity. For the protection of this discovery he took out a patent, and immediately proceeded to establish works at Bathgate, Linlithgowshire—this locality having been selected on account of the existence of the Boghead Coal-mines in the immediate neighbourhood. From this small beginning there has rapidly been developed one of the largest chemical factories in the kingdom, with works covering twenty-five acres of ground and furnishing lucrative employment to upwards of 600 men.

The establishment of this factory furnishes a convincing reply to those pseudo-philanthropists who bewail the decline of simple pursuits requiring unskilled labour, and think that the developement of the manufacturing over the agricultural system is the bane of the country. When the Paraffin Works were first established at Bathgate, the village was chiefly occupied by hand-loom weavers whose average earnings amounted to about 6s. per week. These weavers have now become the intelligent workmen of the factory, their earnings having been trebled by the change; and even the unskilled labourers receive more than double the previous average earnings of the district.

A French Ice Machine.

Small machines have lately been made and sold in Paris, for making ice. A late number of *L'Illustration Univerielle* gives an illustrated description of one. A cylinder of sheet tin, with a movable cover at one end, to be kept tightly in its place by a screw when shut, with two openings, one at each end, to receive through two funnels the materials used, and a discharge cock at one end to discharge the contents when the cylinder is to be emptied, are all the apparatus required. This cylinder, when properly charged, is placed on a pair of rockers, to convert five hundred French grammes of water into ice (each gramme being nearly seventeen grains avoirdupois) it is necessary only to place in this cylinder or well, twelve hundred grammes of sulphate of soda and eight hundred grammes of hydrochloride or muriatic acid. Into this preparation or bath, says the inventor, place a form or vessel containing the water to be frozen. Close the cover fast, and then for seven or eight minutes give the cylinder a see-saw motion on its cradle, and you obtain the desired result. A solid block of ice of five hundred grammes may be produced by this operation. It is well known that ice may be thus produced, by the use of refrigerating mixtures; but at a cost apparently greater than is charged for ice in New York, even at its present exorbitant price. But in warm climates, where ice has to be imported from great distances, a good ice machine may be of great importance. A French ice machine was illustrated on page 256, Vol. V., (new series), *Scientific American*, and an English one on page 72, same volume. This latter machine is the most complete for the purpose, although expensive, that has yet been devised. It was invented in Geelong, Victoria, and large blocks of ice have been made by it.

Caoutchouc.

This gum, usually called Indian Rubber, because it was originally and almost solely employed to rub out black lead pencil-marks, was first sold in England (as Dr. Andrew Wynter reports) for seventy-five cents for a cubical piece of half an inch. This was in 1770, and the vendor was Mr. Maine, mathematical instrument maker, opposite the Royal Exchange, London. Its employment now, in manufacture and art, would require a volume to describe, and it is surmised that its uses may be very largely extended.

Berlin and Vienna.

The chief cities of the two great Powers of Germany, are according to the latest official accounts, very nearly equal in population. The Prussian capital numbers 527,000 inhabitants; the Austrian 530,000. As much as 26,385,000 florins (more than two and-a-half million pounds sterling) is paid annually in Vienna in the way of rent; while in Berlin the amount is 27,382,000 florins. The half million Viennese live in only 9,900 houses, while the Berliners occupy 21,600. The number of persons living in one house in Vienna is therefore no less than fifty-four while in Berlin the number is nearly twenty-five.