THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

NOVEMBER, 1864.

RESIN AND TURPENTINE.

Communication from the Bureau of Agriculture.

In the August number of this Journal we referred at some length to the importance of turning our attention to the manufacture of Resin and Turpentine, especially pointing to the opportunity of doing so with advantage during the present high prices of these articles, caused by the troubles in the Southern States of America. The Agricultural Association of Upper Canada also offered liberal prizes for specimens in competition at their late Annual Exhibition in the city of Hamilton, which brought out some very fine samples, comparing favorably with the imported article, as tested by an analysis on behalf of the Association, by Professor Croft, of University College, Toronto.

As further shewing the importance of these manufactures, we have great pleasure in laying before our readers a communication from the Provincial Bureau of Agriculture and Statistics, accompanied by statistical tables of the quantities of Resin and Turpentine imported into the United Kingdom from foreign countries, during the years 1859–1863.

We have no idea that our home supply will be equal to our home requirements for some years to come; but it is well to be assured that, should it ever exceed our demands, the mother country furnishes a market for any surplus quantities we may produce—the computed real value of both articles imported by her in 1863, amounting to no less a sum than £569,289 stg., or $2,846,445.

The following is the communication referred to:

BUREAU OF AGRICULTURE AND STATISTICS,
PATENT OFFICE,
QUEBEC, *17th October*, 1864.

SIR,—I have the honor to transmit herewith, copy of a tabular statement, received from the Imperial authorities, through His Excellency the Governor General, on the relative quantity and price of Resin and Turpentine, as shewn by the trade returns for the years 1859, 1860, 1861, 1862 and 1863.

His Excellency the Governor-General is desirous that such information should be sent to proper parties, in view of their diffusion. The object of the Imperial authorities is evidently to foster the production in the colonies, and forwarding to the mother country of the two articles mentioned.

You will therefore be kind enough to use whatever means within your reach, to comply with the above explained intentions.

I am, Sir,
Your obedient servant,
J. C. TACHÉ,
Dep. Minister of Agriculture.

To the SECRETARY of
Board of Arts and Manufactures for Upper Canada, &c., Toronto.

Quantity and Computed Real Value of RESIN *imported into the United Kingdom* (1859-1863).

COUNTRY.	QUANTITIES.				
	1859.	1860.	1861.	1862.	1863.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
France	4,258 7s. 10d.	......	66,790 17s. 6d.	265,158 19s. 11d.	365,958 27s. 11d.
United States	876,806 7s. 9d.	601,646 5s. 11d.	457,686 12s.5d to 10s. 7d.	47,258 18s 5d to 20s. 2d.	2,389 20s. to 29s. 6d.
Hamburg	6,215 8s. 9d.	......	32,203 17s. 5d.	5,639 24s. 3d.	4,318 28s. 6d.
Turkey	......	......	......	......	9,763 27s. 10.
Greece	......	......	......	......	9,568 27s. 7d.
Bremen	......	......	26,594 17s. 9d.	7,739 16s. 4d.	......
Other parts	10 7s. 6d.	11,159 5s. 11d.	14,807 17s. 9d.	13,217 15s. 3d.	3,397 30s.
Total	880,789	612,705	598,080	339,011	385,388

COUNTRY.	COMPUTED REAL VALUE.				
	1859.	1860.	1861.	1862.	1863.
	£	£	£	£	£
France	1,676	......	58,361	263,223	496,477
United States	339,064	178,990	268 126	44,272	3,506
Hamburg	2,724	......	28,039	6,844	6,147
Turkey	......	......	......	......	13,583
Greece	......	......	......	......	13,211
Bremen	......	......	23,640	6,338	......
Other parts	4	3,338	13,165	10,128	5,091
Total	343,408	182,328	391,331	330,805	538,015

Quantity and Computed Real Value of TURPENTINE *imported into the United Kingdom* (1859-1863).

COUNTRY.	QUANTITIES.				
	1859.	1860.	1861.	1862.	1863.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
France	......	......	3,745 20s.	8,726 23s. 4d.	14,146 23s. 7d.
United States	226,083 9s. 10d.	185,145 9s. 3d.	99,277 11s.3d to 12s. 11d.	3,120 23s. 6d.	......
Hamburg	5,852 9s. 9d.	......	6,974 15s. 6d.	......	......
Bremen	21,293 10s. 2d.	......	2,066 10s. 7d.	......	......
Greece	......	......	......	......	11,587 22s. 1d.
Other parts	3,435 10s. 4d.	829 9s. 8d.	250 10s. 1d.	876 27s. 6d.	1,610 22s. 7d.
Total	256,663	185,474	112,312	12,722	27,348

COUNTRY.	COMPUTED REAL VALUE.				
	1859.	1860.	1861.	1862.	1863.
	£	£	£	£	£
France	......	......	3,752	10,196	16,676
United States	111,556	85,868	58,821	3,666	......
Hamburg	2,847	......	5,420	......	......
Bremen..............	10,808	......	1,097	......	......
Greece	......	......	......	......	12,783
Other parts	1,768	152	239	1,204	1,815
Total	126,979	86,020	69,329	15,066	31,274

Quantity and Computed Real Value of RESIN *and* TURPENTINE *imported into the United Kingdom* (1859-1863).

COUNTRY.	QUANTITIES.				
	1859.	1860.	1861.	1862.	1863.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
France	4,258	......	70,535	273,884	370,099
Turkey	......	......	......	......	9,763
United States	1,102,389	786,691	556,963	50,378	2,389
Greece	......	......	......	......	21,155
Hamburg	12,067	......	39,177	5,639	4,318
Bremen..............	21,293	......	28,660	7,739	......
Other parts	3,445	11,488	15,057	14,093	5,007
Total	1,143,452	798,179	710,392	351,733	412,731

COUNTRY.	COMPUTED REAL VALUE.				
	1859.	1860.	1861.	1862.	1863.
	£	£	£	£	£
France	1,676	......	62,113	273,419	513,153
Turkey	......	......	......	......	13,583
United States	450,620	264,858	326,947	47,938	3,506
Greece	......	......	......	......	25,994
Hamburg	5,571	......	33,459	6,844	6,147
Bremen..............	10,808	......	24,737	6,338	......
Other parts	1,772	3,490	13,404	11,332	6,906
Total	470,447	268,348	460.660	345,871	569,280

PROVINCIAL EXHIBITION, U. C., 1864.

The nineteenth Annual Exhibition of the Association, held in the City of Hamilton, during the last week of September, has been so fully described in the daily and weekly journals of the Province, that little is necessary for us to do beyond securing in our pages a record of some of its leading features—more particularly those referring to the Arts and Manufactures department. We do not, therefore, intend to notice in detail the various objects on exhibition, with the exception of a few of the more important ones.

The receipts at the gates, and for members' tickets, for the present and two past years, were, in round numbers, as follows:—

	Toronto, 1862.	Kingston, 1863.	Hamilton, 1864.
Tickets sold at gates, @ 25c.	43,228	16,000	27,000
Members' tickets sold @ $1.	2,315	1,175	2,000

The following comparative statement of the number of entries in the whole of the departments, for the same years, willfurnish a pretty correct view of its success as an exhibition:—

	Toronto, 1862.	Kingston 1863.	Hamilton 1864.
Horses	428	381	416
Cattle	620	401	541
Sheep	633	484	693
Pigs	208	106	150
Poultry	250	189	284
Grains and Seeds	460	512	580
Roots and Field Crops......	386	285	388
Horticultural Products	1,197	582	1,109
Agricultural Implements—power	186	149	172
Agricultural Implements—hand	142	107	128
Arts & Manufactures Dep't.	1,676	1,142	1,517
	6,186	4,338	5,978

The following table shows the number of entries, amount offered in prizes, and amount actually awarded—including extra prizes, in the Arts and Manufactures department for the present year:—

Class.		No. of Entries.	Amount of Prizes offered.	Amount of Prizes awarded.
40	Cabinet Ware and other Wood Manufactures ...	39	$188 00	$103 00
41	Carriages & Sleighs, and parts thereof	64	181 00	151 00
42	Chemical Manufactures & preparations	38	98 00	78 00
43	Decorative & Useful Arts, Drawing and Design ...	80	225 00	165 00
44	Fine Arts	280	497 00	439 00
45	Groceries and Provisions.	58	132 00	109 00
46	Ladies' Work	371	163 50	186 00
47	Machinery, Castings, and Tools	84	353 00	223 00
48	Metal Work (Miscellaneous), including Stoves.	50	300 00	144 00
49	Miscellaneous, including Pottery & Indian Work	96	125 00	150 00
50	Musical Instruments......	30	139 00	67 00
51	Natural History...........	11	98 00	56 00
52	Paper, Printing, & Bookbinding	30	82 00	32 00
53	Saddle, Engine-hose, Trunk-maker's work, and Leather..............	55	228 00	121 00
54	Shoe and Boot-maker's Work, and Leather ...	63	143 00	93 00
55	Woollen, Flax, & Cotton Goods, Furs, & Wearing Apparel	140	485 00	159 00
56	Foreign Manufactures (no money prizes offered)........................	28		
		1,517	3437 50	2576 00

Although the aggregate number of entries was large, amounting to nearly three times the number of entries taken at the recent Show for the State of New York (2,209 in all departments), yet many of the most important articles in manufactures were entirely unrepresented.

In Class 40 there were no entries of Dining or Bed-room Furniture, or Joiner's work. The most noteworthy articles were a set of superb drawing room furniture, including a beautiful inlaid centre table, exhibited by Messrs. Jacques & Hay, of Toronto; and some excellent veneers from Canadian woods.

In Class 41 Carriages and Sleighs were pretty well represented; and some excellent specimens in good taste and of superior workmanship were shewn.

In class 42 entries were made in most of the leading articles of the class—the competition however was very limited. Some new articles of Canadian manufacture were here exhibited, such as Resin, Turpentine, and Colors in powder. The turpentine of Mr. Irish, of Colborne, and of Messrs. Connell & Cotter, of Hastings, were both very excellent articles, and stood the test of analysis very well. A specimen of turpentine by Mr. Luke, distilled directly from the wood, although not equal to the others in quality, is a very clear article, and can be afforded wholesale at about $1 per gallon, being less than one half the price of either the other specimens. We were assured that it answers the purpose of the painter very well for common work.

In Class 43 entries were made in all the sections except for gold and silversmith's work. W. C. Chewett & Co.'s and Brown & Bautz's Lithography; McCausland's stained glass; and Hurd & Leigh's decorated porcelain and china, were all very attractive.

In Class 44 the entries were numerous in almost all its sections. This department appeared to be above the usual average of Provincial Exhibitions, and gave good promise for art in the "Future of Canada."

In Class 45 the sections were nearly all represented, although the competition was very limited.

In Class 46, Ladies' work, entries were made in every section. The articles were so numerous and so elaborately worked, as to render it difficult for the judges to complete their awards, although two committees of ladies were appointed for the purpose.

In Class 47 the large collection of crank axles, car springs, axle boxes, taps, connecting rods, car wheels and other railway castings and machinery, exhibited by Mr. Sharp of the Great Western Railway works, received the highest commendation of the judges. Messrs. McKechnie & Bertram, and W. H. Gibson, of Dundas, each exhibited a fine collection of machines for various purposes. One of the most ingeniously constructed machines we have seen in Canada was the card clothing machine of Eyre & Theurston, Ancaster. It is almost perfectly automatic, requiring little or no attendance, but goes on with its forty or fifty movements, taking its exact length of fine card wire, cutting it off and bending it twice at right angles, perforating the leather and inserting the wire, giving it the exact spring, and perfecting the cloth for covering the scribbling and carding engines used in cotton and woollen mills. A very excellent fire engine was also shown in this class by Mr. Marks, of Toronto.

We must not fail to notice a circular saw mill for cutting boards, of very simple construction, by C. H. Waterous & Co. of Brantford. This mill was in operation, and did its work most effectively, and to the admiration of crowds who were continually surrounding it. We would also notice a newly patented steam engine, also in operation, the invention of Mr. Thos. Northy, of Hamilton, to which the first prize was awarded. We are aware that Mr. Northy holds testimonials and certificates from parties using his engine, as to its efficiency and economical working. We expect to be able to give a drawing and description in our next No. In several sections of this class no entries were made.

Class 48 was not represented in Coppersmith's Work, Files, Iron-fencing, and Malleable Hardware. In Engineer's Brass Work, Fire-arms, Office Safes, Nails, &c., there was a fair competition, and the articles were good. In Stoves there was little competition.

In Class 49 the most important entries were for Boats and Models of Vessels (of which there were an unusual large number), Stone-ware, Pottery, Sewage Pipes, and Glassware. This last is a new branch of manufacture just commenced in Hamilton, and ought to be liberally supported.

Class 50 was well represented by Mr. Thomas and Mr. Knott of Hamilton, and Mr. Fox of Kingston, in Pianos; by Mr. Williams of Toronto, and Messrs. Andrews of London, in Harmoniums and Melodeans, and by Mr Roome of Toronto in a Church Organ.

In Class 51 there were entries, but no competition, in each of the sections of Stuffed Birds, Insects, Native Plants, and Minerals. The specimens were good.

In Class 52 all the sections but Paper-hanging, Pocket-books, and Printing-type were represented, although the competition was very limited.

In Class 53, the quality of some of the Harness was superior to any shown at any previous Provincial Exhibition, while in Saddles there were but two entries; and in Belting, Trunks and Valises, none. The show of Leather, although good, was much smaller than usual.

In Class 54 the assortments of Boots and Shoes were very excellent, but no competition. A very large and varied assortment of Machine made Boots, by Nisbett &c. of Hamilton, elicited the highest commendation from the judges. The show of Leather in this class, although excellent in quality, was less in quantity than usual.

In Class 55 the deficiency was very marked, there being but few entries in any sections of the class, and in most of them little or no competition. The importance of our Woollen Manufactures are now so generally understood and appreciated, as to cause a feeling of disapointment in the minds of the public when not properly represented at these annual gatherings. We cannot account for the absence of competition on any other ground than the apathy of manufacturers. There was nothing shown from the mills of Messrs. Frazer and Crashaw, Cobourg; Messrs. Barber Brothers, Georgetown; or other leading manufacturers in the province—with the exception of the large and excellent assortment of Knitted goods by J. S. Crane, Ancaster, and W. Slingsby's admirable Blankets, from the same town. There were no entries of Flax or Cotton Bags, Broad Cloths, Satinets, or Tweeds. We were much surprised to see a first prize awarded as "Kersy for Horse Clothes" to a piece of common coarse Flannel; and entries of "Check for Horse Collars" of material of somewhat the same nature, while to our knowledge a good article of each kind has been manufactured in the country for the past 20 years.

We were disappointed, in view of the liberal prizes of upwards of $100 for linen Goods, that nothing of the kind was exhibited.

We know not whether it arises from feelings of jealousy towards each other, fear of competition, or indifference to the matter, that the leading manufacturers of this Province evince so little interest in these exhibitions, and so many important branches are left entirely unrepresented. Did they possess but a small share of the feeling indulged in by our Agriculturists and Horticulturists, this complaint would not have to be made. Perhaps it arises from the frequency of local exhibitions in every part of the country, or from the system of awarding prizes—of which we may have something to say in our next; but from whatever cause, it is to be regretted, as the occasional bringing together the manufacturers with their products, face to face, induces improvement in both the styles and qualities of their manufactures.

The corrected list of prizes awarded will be found in other pages of this No. of the Journal.

AGRICULTURAL ASSOCIATION OF UPPER CANADA.

Annual Meeting.

The Annual Meeting of Delegates was held in the large committee room on the exhibition ground, Hamilton, on the morning of Friday the 30th of September, at 10 o'clock.

There were present the following gentlemen, members of the Board of Agriculture:—Col. E. W. Thomson (President); Hon. D. Christie; Hon. Geo. Alexander; Hon. A. A. Burnham; Col. R. L. Denison; Dr. Richmond; W. Ferguson, M.P.P.; and Hon. H. Ruttan.

The members of the Board of Arts and Manufactures present were:—Dr. Beatty (President); Prof. Buckland; John Shier; E. A. McNaughton; Thos. Sheldrick; W. Bowman; Hon. E. Leonard; Murray Anderson; James Cummings; Thomas McIlwraith; Arch. McCallum and H. M. Melville.

The officers of the Association present were:—Col. Johnson, Pres't (in the chair); J. C. Rykert, Esq., Vice-President; Hugh C. Thomson and W. Edwards, Secretaries.

The several County Agricultural Societies, and City and Town Horticultural Societies, were represented by upwards of 70 delegates.

After the reading of minutes of previous annual meeting, the election of office-bearers for the ensuing year was proceeded with, resulting as follows:—

President—J. C. Rykert, Esq., St. Catharines.
First Vice-President—N. J. McGillivray, Esq., Glengary.
Second Vice-President—J. P. Wheler, Esq., Scarborough (Woburn P. O.).
Treasurer—R. L. Denison, Esq., Toronto (Lippincott P. O.).

On motion that the exhibition of 1865 be held in London, C. W., Col. Denison, as Treasurer, wished to know if the corporation of that city was prepared to give satisfactory guarantees to provide the necessary accommodation, as required by the rules of the Association.

Mr. Mayor Cornish submitted a document over the seal of the corporation of the city, giving all the guarantees necessary, which was considered satisfactory by the meeting. The motion to hold the next exhibition in London was then carried unanimously.

A lengthy discussion ensued on the subject of the Agricultural Bill, as submitted at the last session of Parliament. A resolution was finally carried, approving of that Bill, and "requesting the Hon. Messrs. Christie, Alexander and Burnham, of the Upper House, and the members of the Lower House, to look after said Bill and endeavour to have it passed."

The Treasurer, Mr. Denison, moved the resolution of which notice had been given for the last three months in the *Canada Farmer* and the *Journal of the Board of Arts and Manufactures*, that the by-laws be amended, so that members, instead of season tickets, should receive four single tickets, each entitling to one admission.

After some discussion, the motion was put and carried.

Motions of thanks were unanimously carried to the retiring president, Col. Johnson; to the railway and steamboat companies, for their liberality in carrying freight and passengers to the exhibition and return at reduced fares; to the local committee for the valuable assistance they had rendered; and to the mayor and corporation of the city of Hamilton, for the ample manner in which they had carried out their engagements.

PETROLEUM AS FUEL.

The following article and correspondence is from the *London* "Oil Trade Review," a weekly journal issued from the office of the "Grocer." The subject treated of has been discussed and experimented upon on this side the Atlantic for some time past, as one of great interest both to the oil-producers and to the steam-shipping interests. If a really successful mode of using petroleum as fuel for raising steam in ships has been discovered, it will, apart from mere comparative cost of coal and petroleum, be invaluable to vessels engaged in lengthy sea voyages. Should such a new demand for petroleum be created, we doubt not but many new sources of supply will also be discovered, to meet the increased demand.

"It appears that the use of petroleum as fuel as a substitute for coal on board ships is not unlikely to prove a success, notwithstanding the failure, as regards comparative economy, of the various experiments mentioned from time to time in these columns. We have been favoured by Mr. C. J Richardson, architect, with a private view of a process conceived by him, without the knowledge of any other being previously tried; he not having become aware of that fact till it was pointed out to him in a recent number of this journal. His plan, therefore, has the merit of being purely original, as far as he is concerned. We were much interested in the preliminary experiments we saw tried, which lead us to hope very strongly that the philosopher's stone has at last been found. Petroleum as a fuel to the steam engine at a less or equal cost would completely revolutionize our system of steam navigation. One great desideratum in its use is the utilization of the whole, or nearly the whole, of the material applied. This, we are inclined to think, is accomplished in the process adopted by Mr. Richardson, though the apparatus is not in a sufficiently forward state to enable us to make a practical test from which to derive our calculations. The invention has been submitted to the Admiralty; and as soon as we hear the result we shall give our readers full particulars concerning it. At present we do not feel ourselves at liberty to give any details, as steps are only now being taken to secure for it the American and Continental patents. Steam power in long voyages is now used only as an auxiliary to sails; but should we succeed in finding an economical substitute in petroleum, the order of things will be reversed. The Admiralty send out to China every year immense quantities of coal at 15s. per ton for their vessels; all the great companies navigating those seas send out coal, the depôts for which are kept up at an enormous cost, in addition to the great amount of labour entailed in its use, and the room required for its storage in ships. If petroleum *could* be substituted it would be a great commercial triumph."

Petroleum as Fuel.

"Sir,—Being engaged in perfecting a method for burning petroleum as steam fuel on a very simple principle, using for the purpose an extremely small apparatus, for which I have taken out both English and foreign patents, I read carefully over the late articles that have appeared in your paper relative to the subject.

"The impression gained from them, especially that of the 6th August, is, that it was our common coal that was used against petroleum, by the Commission appointed by the American Government to examine and report on the subject, and likewise by Professor Fisher, of Newhaven, and that 198 gallons of the oil were found to have only the same heating power as 2,000 lbs. of coal. Premising that I believe the processes upon which the experiments were made wasted half the oil, it was not our common coal that was used, but anthracite coal, one akin to petroleum. Its effect as a fuel is the rapid production of an intense heat, confined to a surface not extending more than a few inches above the bars, and acting in that way, is, I believe, much more powerful than the English coal. It is commonly used in New York; the Americans understand it, we do not. The price of the Welsh anthracite coal is 1*l.* 7s. per ton in London, and that is not so good as the American.

"Professor Fisher's experiments were carried out only on a small scale. To fully settle the comparative value of the oil against coal, an oil-burning apparatus should be kept in full operation for eight or ten hours, under the boiler of an engine of at least six-horse power.

"The statement relative to the *Persia* steam vessel is to be found in the report of the American Commissioners. Now our cousins are very 'cute calculators. I should long hesitate to put aside as worthless anything they brought forward on such a subject, especially if it was with the sanction of the head engineer of the American Navy. But, Sir, admitting that for all common purposes the present price of petroleum renders it incapable of competing with coal as steam-fuel, there are many items which add to the price of coal for a great ocean steamer, which must be taken into consideration. The first price here is a very small part of the matter. It is a subject of great importance, and should not lightly be slurred over. The yearly yield, or take, from our coal-fields is 90,000,000 tons. The exportation of coals from this country amounted in 1862 to 7,671,670 tons. Of this quantity, probably 100,000*l.* worth were sent by our Government alone for the use of the steamships in China and the India Seas. Our great steam-ship companies send their portion. There is the expense of carriage, the establishing and keeping up coaling stations, offices, clerks, servants, *et genus omne.*

"Stopping for coals causes great delay; vessels are compelled to deviate widely from the best tracts to the necessary coaling stations. Steamships sometimes lose from twelve to twenty days in this manner. Coals obtained on the India and Australia route cost on the average from four to five times per ton as much as in this country.

"The oil is more distributed throughout the world than coal. There are stations where the prices of oil and coal are reversed, the oil being the cheapest. There are large ocean tracts where coal cannot be procured at all, but where probably oil abounds, where our steamers at present are never seen—at least, they are certainly able to supply themselves from the cheapest market, without depending upon England for the supply.

"Against coal must be placed the army of stokers required, the injury done the engines, and the waste of fuel in the heavy smoke, and the great space lost for merchandize by the size of the coal bunkers.

"On the sea, the great, the open sea, what is the position of steam at present? Why, it is an auxiliary to sails merely. The fires are lighted when there is no wind. As soon as a favourable breeze springs up, they are extinguished, so bulky, and therefore so costly, are the coals.

"All this, Sir, must be considered when we calculate the expense of coals for steam navigation, but there is something more. If steam was the principal, and sails the auxiliary, a ship could leave England with a rig at present seen only on vessels navigating along our own coast. There would be nearly the whole expense of masts, sails, rigging, &c., saved; there would be fewer shipwrecks, no men lost off the yards while furling sails in tempestuous weather; fewer sailors engaged in each ship, but more vessels sent to sea. On our men-of-war the chief duty of our sailors would be to attend to their guns, no longer the mild weapons of former times. Ships could make short direct passages without turning aside for fuel, time would be saved, and labour, more costly than the most expensive fuel, reduced in cost.

"I firmly believe that petroleum will be the means of thus fully developing steam navigation. It certainly is the proper steam-fuel. It can be kept in one constant flame, without slack, the heat taken to the boiler, the grate kept cool, an excess of oxygen admitted between the bars.

"The apparatus I wish to introduce is in the form of a moveable grate, that could be wheeled under any engine, the coal-grate being temporarily removed, enabling the engine to burn either coal or etroleum, as desired; the latter without waste, and so completely under command that, if there were a dozen furnaces on board a ship, all the grates could be supplied with oil at one operation by the engineer, sitting at his table away from the engine-room. It would burn its own smoke, and heat the feed-water for the engine.

"To prevent the too quick exhaustion of our coal-fields, by any means, would be effecting a national service. Projectors endeavouring to use petroleum for the purpose should not be told 'that its introduction as a fuel is one of the wildest dreams that was ever conceived.' It is not so. Parties who look to the use of petroleum as a fuel should have souls above calculating the results for a Gravesend packet. They should take enlarged views, and they may rest assured that, however large such views may be, petroleum will be found fully capable of meeting them.

"I am, &c.,

"C. J. RICHARDSON."

DR. ROSEBRUGH'S OPHTHALMOSCOPE.

This instrument, of which a full description was given in the March No. of this Journal, in a paper read before the Canadian Institute, is receiving the attention and commendation of medical and other scientific men, able to appreciate the benefit to be derived from the Dr.'s invention.

The following is from the Buffalo *Medical Journal*, of a recent date:—

"The new Ophthalmoscope, of which a full description appeared in this journal for May, the invention of Dr. Rosebrugh, oculist, of Toronto, proposes to do away with the objections to the ordinary Ophthalmoscope, to which we have refered. We have had the pleasure of putting Dr. Rosebrugh's instrument to a practical test, and we have great pleasure in reporting that it is all that it claims to be, namely: an Ophthalmoscope that will demonstrate the fundus of the eye to any person without any previous knowledge of the mode of using it. In brief, the great advantage of Dr. Rosebrugh's Ophthalmoscope consists in the limited experience necessary in order to use it satisfactorily; thus placing it within the reach of every medical practitioner. There is another feature in this new instrument of no little importance, namely: it can be adapted to a small camera obscura, upon the ground glass plate of which the image of the fundus oculi can be thrown so as to be seen by a number of persons at the same time; and still farther, a prepared photographic plate being placed in the position of the ground glass plate, photographs can be taken showing the details of the deep structure of the living eye. We have one of these photographs in our possession, showing very clearly the optic nerve entrance and the distribution of the vessels of the retina of a cat."

The American *Quarterly Journal of Science*, No. III, July 1864, at the close of an article giving a description of the instrument, also commends it in the following manner:—

"We welcome with much pleasure this ingenious attempt to still further extend the important applications of light painting, which of late have received so many new extensions; we can hardly conceive of any that can be more valuable than this suggestion, for not only are the structures so minute and so delicate, but so varied and so numerous, that it is most difficult even for the fully initiated to clearly define them so as to make them clear to a bystander. Hence there is little wonder that a non-professional artist who knows not what he is to see, should be puzzled to make them out, and still more so to depict them. Of this every writer, Mr. Hogg* among the number, complains, and all find it most difficult and costly, sometimes almost impossible, to obtain truthful representations of those numerous changes in the eye, which the pathologist is so anxious to secure. Should hereafter photography be capable, as we now incline to hope it may be (it has already been most usefully employed in depicting accurately and cheaply external changes and diseases), at no very distant time, of illustrating the hitherto hidden recesses of the human eye, it will supply a desideratum of no ordinary importance; for an absolutely correct picture of the living eye in health and disease will then be within the easy reach of every student of medicine, and thus one great cause of ignorance will be removed. While, therefore, Dr. Rosebrugh cannot as yet lay claim to complete success, he deserves credit for the advance which he has made on the road to it."

ALPHABETICAL LIST OF RECENT ENGLISH PUBLICATIONS.

Barry (P.) Dockyards, Shipyards, and Marine of France, 8vo	0	10	6	*Simpkin.*
Carmichael, Art of Marine Painting in Oil Colours	0	1	0	*Winsor & Newton*
Cooper's Chart of 187 Mechanical Movements, 8vo	0	1	6	*Cooper.*
Dowling (Chas. H.) Series of Metric Tables: the British Standard compared, 8vo.	0	10	6	*Lockwood.*
Examination Papers for Engineers, Officers, &c., Feb. and June, 1864	0	1	0	*Simpkin.*
Low (Sampson) English Catalogue of Books, 1835—Jan. 1863, roy. 8vo	2	5	0	*Low.*
Ramsay (A. C.) Physical Geology & Geography of Great Britain, 2nd ed., post 8vo.	0	5	0	*Stanford.*
Rarey on Horse Taming	0	1	6	*Routledge.*
Transactions of the Society of Engineers for 1863, cr. 8vo	0	10	6	*Spon.*
Watson's Handbook of Calisthenics and Gymnastics	0	8	0	*Trübner.*

RECENT AMERICAN PUBLICATIONS.

Bentwrights American Horse Tamer and Farrier, 12mo	$0	30	*J. R. Hawkley.*
Chemistry, Principles of, by Prof. John A. Porter, 325 illustrations	1	75	*Barnes & Burr.*
Devine's Photographic Chemistry and Manipulation	1	00	*Seely & Boltwood.*
Dussance on Fabrication of Matches, Colored Fires, Fulminating Powders, &c	3	00	*H. C. Baird.*
Hally's Art of Saw Filing, with full directions, from Jewellers' Saw to a Steam Saw Mill	0	60	*John Wiley.*
Kirkland's Cyclopedia of Commercial and Business Anecdotes, 2 vols	6	00	*D. Appleton & Co.*
Norris' American Angler's Book—Fly-Fishing, Fly-Making, Rod-Making, &c	6	00	*Butler & Co.*
Rimmer's Elements of Design. Book 1st., 8vo, 36 plates	3	00	*S. R. Urbine.*
Storer's 1st Outlines of a Dictionary of Solubilities of Chemical Substances, part 3	2	00	*Sever & Francis.*
Tanner's Memoranda on Poisons	0	50	*Lindsay & Blakiston*
Towler's Silver Sunbeam; on Sun Drawing and Photographic Printing	2	50	*J. H. Ladd.*
Veitelle's Mercantile Dictionary of Technicalities of Commerce, Names of Articles of Trade, Marine Terms, &c.; in English, Spanish, and French	3	00	*D. Appleton & Co*

Selected Articles.

PROCEEDINGS OF THE SOCIETY OF ARTS.

CANTOR LECTURES.

"On Chemistry Applied to the Arts." By Dr. F. Crace Calvert, F.R.S., F.C.S.

LECTURE IV.

Delivered on Thursday Evening, April 21st, 1864.

Animal Fatty Matters, the various processes for liberating them from the tissues in which they are contained. Their composition and conversion into soap. Composite candles. The refining of lard. *Cod-liver, sperm,* and other oils. *Spermaceti* and *wax.*

It will be quite out of the question for me to enter upon a general description of the properties and compositions of fatty matters, as to do so would be to undertake far too wide a field of research. All that I can attempt in this lecture is to give an idea of their composition, and to describe some of their most recent applications to arts and manufactures.

The question of the source of the fatty matters in herbiverous animals has been the subject of a great number of scientific researches, but those of Baron Liebig, Dumas, Boussingault, Payen, and Milne Edwards, have left no doubt that when the food of an animal contains a sufficient amount of fatty matter, this is simply extracted from the food, and stored or consumed according to the animal's habits, that is to say, its consumption is in ratio to the activity of the animal; thus, an animal in a state of great activity is comparatively thin, but when confined in a pen or stall it quickly fattens. These gentlemen also proved that when the food is deficient in fatty matters a portion of the amylaceous or saccharine matter becomes converted into fatty matter. The most decisive experiments on this head were made by Mr. Milne Edwards, who found that when bees were confined under a glass shade, with no food but honey, they converted the greater portion of it into wax. Notwithstanding these proofs, however, chemists found it difficult to understand how substances so rich in

* Manual of Ophthalmoscope Surgery.

oxygen as amylaceous ones became converted into a class of matters containing so little of that element, but Baron Liebig has recently published a paper which has partially solved this problem, showing that animals give off during respiration a larger amount of oxygen than is contained in the air inspired, which excess must be derived from certain organic substances circulating in the blood. Fatty matters may be classed under two heads, viz., vegetable and animal. The first are generally composed of a solid, called margarine, and a liquid, called oleine. The latter generally contains three substances, viz , two solids, stearine and margarine, and one liquid, oleine. I say generally because there are exceptions; thus in palm oil palmetine is found, in linseed oil linoleine, in sperm oil spermaceti, and in waxes several peculiar acids. Let us now examine the composition of some of the most abundant fatty matters found in animals. The knowledge of the composition of these substances, of suet for example, was most unsatisfactory until 1811, when my learned and eminent master, M. Chevreul, published his elaborate researches, by which he demonstrated the real composition of fatty matters in general, and that they might be considered as real organic salts. Thus suet is composed of stearic, margaric, and oleic acids combined with the oxide of glyceryle. The three above-named acids he showed to be composed as follows:—

	Stearic acid.		Margaric acid.	Oleic acid.
Carbon	68	...	34	36
Hydrogen	66	...	33	33
Oxygen	5	...	3	3
Water	2	...	1	1

also that oxide of glyceryle, as it is liberated from the fatty acids, combines with water and forms glycerine. He further shewed that when fatty matters were saponified, the change consisted in the substitution, for the oxide of glyceryle, of the oxide of sodium or soda in ordinary hard soaps, of the oxide of potassium and potash in soft soaps, of oxide of lime, baryta, or lead in insoluble soaps. You will easily conceive the pride of Mr. Chevreul when forty years later, M. Berthelot effected the synthesis of the fatty matters, the analysis of which M. Chevreul had published in 1811. This he accomplished by heating in sealed tubes, at a temperature of 520° for several hours, one, two, or three equivalents of each of the above acids with one equivalent of glycerine, leaving the mixture to cool, and then boiling it in a vessel with water and lime, when the excess of fatty acids not combined during the experiment were removed by the lime, leaving the natural fatty matter, which was dissolved by other, and thus obtained in a state of purity. By this interesting series of researches, M. Berthelot has not only reconstituted neutral fatty matters, but showed that oxide of glyceryle was triatomic, that is, that one equivalent of the oxide would neutralise three equivalents of the acid, whilst it required three equivalents of soda to produce a neutral with three equivalents of stearic acid.

Stearic acid, 3 ($C_{68}H_{66}O_5$), Glycerine, $C_6H_8O_6$—4 HO
Stearic acid, 3 ($C_{68}H_{66}O_5$) + 3 Soda NaO—3 HO.

In fact the researches of this eminent chemist on the synthesis of organic substances have effected a complete revolution in the last few years in that branch of organic chemistry.

I shall now proceed to give you a rapid outline of the properties of these substances.

Stearic acid is a white crystalline substance, fusible at 158° F., soluble in alcohol and ether, insoluble in water, and saponified by alkalies.

Margaric acid is a solid crystalline substance, presenting the same properties as stearic, excepting that its fusing point is 140°.

Oleic acid is a fluid remaining in that state even at several degrees below the freezing point of water, and is also soluble in alcohol and ether, but not in water.

Glycerine, or the sweet principle of oils, was discovered in 1779, by Scheele, who extracted it in boiling oil of sweet almonds with oxide of lead, which combining with the fatty acids liberated the oxide of glyceryle, and this, in combining with water, formed glycerine, in consequence of the numerous applications of glycerine in medicine, the French have manufactured this substance on a large scale from the liquors in which they have saponified their fatty matters into soap; but the purest and most extensive supply is furnished by Price's Patent Candle Company. In the course of this lecture I will give you a description of its preparation, as carried out at their works. Glycerine is a colourless, syrupy fluid, of sweet taste, and sp. gr. 1.28, highly soluble in water and alcohol, combining easily with hydrochloric, hydrobromic, benzoic, tartaric, &c., acids, forming neutral compounds. Diluted nitric acid converts it into glyceric acid; concentrated nitric acid into nitro-glycerine, or a substance exploding with violence by percussion, which has caused it to be proposed as a substitute for fulminating mercury, by its discoverer, Professor Sobrero. The application in medicine of glycerine has been greatly extended by its highly hygrometric properties. Thus, bandages moistened with glycerine remain constantly moist, because the glycerine attracts moisture from the air as fast as it is lost by evaporation. It has also been found eminently useful in diseases of the eye and ear. Glycerine boils at 527°, but when distilled is partly decomposed into a peculiar oily fluid, of a noxious odour, called acroleine. M. Bertholet has succeeded, by fermentation, in converting glycerine into alcohol. Again Mr. G. Wilson, F..R.S, the talented director of Price's Patent Candle Company, has applied glycerine with great success to the preservation of vegetable and animal substances. Another useful employment of glycerine is its substitution for water in gasometers, where the evaporation of the latter is a source of serious loss. Its addition to a soap solution increases the facility of forming soap bubbles to an extraordinary degree. In fact, by its aid, bubbles of seven or eight inches diameter can be produced, exhibiting most beautiful purple and green colours, the beauty of which is greatly enhanced, as Mr. Ladd will show you, when illuminated by the electric light. To prepare this peculiar soap solution the following proportions are stated to be employed:—Distilled water, 5 ounces; soap, $\frac{1}{8}$ of a dram; glycerine, 2 drams.

The extraction of the fatty matters of animals from the tissues enveloping them is a simple operation. The old process of doing this, technically called "rendering," consisted in introducing the suet into large iron pans and applying heat, which caused the fatty matters, by their expansion, to burst the cells confining them, and to rise to the top of the contents of the boiler, which were left to stand for a few hours, and the liquid fat was then run off. The organic tissues remaining with a certain amount of fat at the bottom of the boilers were removed, and subjected to pressure so as to separate the rest of the fat, the organic tissues remaining behind being sold under the name of scraps, for feeding dogs, &c. As this operation gives rise to noxious vapours, causing thereby great annoyance, other methods have been generally adopted. For instance Mr. D'Arcet's, the leading feature of which is, to place in a boiler say 350 lbs. of suet with 150 of water and 15 of sulphuric acid, carrying the whole to the boil for some hours, when the sulphuric acid dissolves the organic matter and liberates the fatty ones, which are then easily separated from the aqueous fluid. Mr. Evrard's process appears preferable. He boils the fatty matters with a weak solution of alkali; or, in other words, he uses 300lbs. of suet with half a pound of caustic soda dissolved in 20 gallons of water, carrying the whole to the boil by means of a jet of steam. Under the influence the alkali the tissues are swollen and dissolved and the fat liberated. By these operations a better quality of fat is obtained and no nuisance is created. It is found advantageous to purify or bleach the above fatty matters by the following means. Mr. Dawson's process consists in passing air through the melted tallow, and Mr. Watson's in heating melted fatty matter with permanganate of potash. Both these processes, as you will perceive, are based on the oxydation of the colouring organic matter. Some tallow melters further clarify their tallow by adding 5lbs. of alum in powder to 100lbs. of melted tallow, which separates and precipitates any colouring matter. The white snowy appearance of American lard, which is rather deceptive to the eye than profitable, is obtained by thoroughly mixing, by means of machinery, starch in a state of jelly with a little alum and lime, with the fatty matter, by which means two ends are attained. viz., the introduction of 25 per cent. of useless matter, and a perfect whiteness from the high state of division of the same. The fatty matters from fish are generally obtained by boiling those parts of the fish containing them with water, when the fatty matters rise to the surface of the fluid, and one whale has been known to yield as much as 100 tons of oil. According to M. Chevreul, the composition of whale oil is as follows:—

Solid fats	Margarine, Cetine,
Liquid fats	Oleine, Phocénine,

together with a small amount of colouring matter, and of phocenic acid, which gives to whale oil its disagreeable colour and odour. Many attempts have been made to sweeten whale oil by the use of weak caustic lye, milk of lime, sulphuric acid, and steam; but although a great improvement has been effected, the oil is still recognizable by its unpleasant odour. I have no doubt in my mind, from experiments made by my friend Mr. Clift, that fish oils might be obtained as sweet as vegetable oils, if proper means for their extraction were adopted. Allow me here to revert to animal fats to show you that their comparative hardness or solidity, as shown by the following table, depends upon their relative proportions of stearine and margarine, or oleine:—

	Stearine or Magarine.	Oleine.	Melting point.
Ox tallow	75	25	111·0°
Mutton suet	74	26	109·0°
Hog's lard	38	62	80·5
Butter (summer)	40	60	86.2
Do. (winter) .	63	57	79·7
Goose fat	32	68	79·0
Duck fat	28	72	77·0

Mr. Pelouze proved some years ago that the rancidity of ordinary animal as well as vegetable oils is due to a fermentation; that is to say, that under the influence of the azotised principle associated with all fats, the fatty matters spilt into their respective fatty acids and glycerine, which in their turn undergo a further change, resulting in the production of volatile fatty acids, such, for example in the case of butter, as butyric, caproic, capric, and caprolic acids; in the case of goat's milk, hirsic acid; of fish oil, phocenic acid. Further, M. Pelouze demonstrated, that in the case of olive oil this change occurred a few hours after the crushing of the berries, the oil thereby coming in contact with the albuminous principles or ferment.

I shall now have the pleasure of calling your attention to some of the special applications which fatty matters receive. The first of these arises out of the action of alkalies upon these substances, the result of which is the conversion of an insoluble matter (oil) into a soluable one (soap). I shall not enter into minute details of this well-known manufacture, but content myself with touching upon some of the most recent improvements. The usual mode of making soap is to add animal fats or vegetable oils to a weak lye, or caustic-solution, carrying the mixture to the boil by means of steam pipes passing through the vessel above a false bottom, and keeping the whole in constant agitation by means of machinery. During this operation the oxide of sodium replaces in the fatty matter the oxyde of glyceryle, and when the lye is killed, that is to say when all its alkali is removed by the oil, a fresh or stronger lye is added, and these operations are repeated until the manufacturer considers that the matter is nearly saponified, which is easily judged of in practice. He then proceeds with a second series of operations, called salting, which have for their object to separate the glycerine and impurities from the soapy mass, and also to render the latter more firm and compact, in fact, to contract it. This is effected by treating it with stronger lye mixed with a certain quantity of common salt, and allowing it to stand for a few hours, so that the mass of soap may separate from the fluid containing glycerine and other impurities. When the second series of operations are finished the clarifying or finishing process follows: this requires the use of still stronger lye and salt, which not only complete the saponification, but separate any remaining impurities; the semifluid mass of soap is then allowed to stand for twelve hours, when the soap is either run or ladled into large wooden moulds, and allowed to stand until quite cold. After standing for a day or so, the wooden frame is removed from the solid mass of soap, when it is divided into bars by means of a brass wire. The difference between *white curd* and *mottled* soap is caused by the addition to the fluid mass of soap of about four ounces of alum and green copperas to every 100 lbs. of soap, which gives rise to an alumina and ferruginous soap, which on being diffused through the mass by means of agitation, mottles or marbles the mass when cool. When well prepared this is the most economical soap, as no large quantity of water can be introduced to weight it, because this would cause the separation of the mottling material from the soap. *Fancy soaps* are prepared in the above manner, by the employment of a better quality of materials and the addition of various perfumes. *Rosin or yellow soap*, as its name implies, is one in which a portion of the fatty matters is replaced by rosin, which is added to the soap paste when there is but little solution of alkali left to dissolve it, so that the rosin can at once enter into the composition of the soap, instead of being dissolved in the alkaline lye and lost. Rosin soaps, nearly white, are now manufactured, owing to the discovery of Messrs. Hunt and Pochin, who have succeeded in obtaining nearly white rosin by distilling common rosin with the aid of superheated steam. *Silicated soaps* are much used in America, owing to their cheapness, which is due to the introduction of a certain amount of silicate of soda. *Transparent soap*, the method of making which was so long kept secret, is now known to be obtained by dissolving soap in alcohol and allowing a concentrated solution of it to cool slowly, when it is poured into moulds and allowed to solidify. One of the most useful and recent improvements in soap-making is that which enables the manufacturer to produce what is called *glycerine soap*, which is characterised by the retention of the glycerine of the fatty matter. Its manufacture only occupies a few hours, instead of several days, as is the case with ordinary soap. It is prepared by employing 63 parts of fatty matter, 33 of water, and 5 of alkali, which are heated to a temperature of between 350° and 400°, for two or three hours when the mass is entirely saponified, and then has only to run into moulds to be ready for the market. But the most important discovery connected with the saponification of fatty matters by means of alkali is that recently made by M. Mèges Mouries, for this gentleman has arrived at the remarkable result of saponifying fatty matter in the space of 12 hours, and, what is more extraordinary still, at natural temperatures. If we connect this fact with the one that caustic soda is now manufactured by tons, it appears highly probable that in a few years the fatty matters of Brazil and Monte Video, instead of being sent to this country as such, will be converted into soap there, and imported thence by us in that form. M. Mouries has discovered the fact that fatty matters are susceptible, under peculiar circumstances, of being brought into a globular state, and that when in that state they present new and peculiar properties. Thus, for example, fatty matters, when kept in a damp state, usually become rapidly rancid, whilst when in the globular state they may be kept for a very long period without undergoing that change. This peculiar state can be imparted to fatty matters by melting them at 113° and adding a small quantity of yolk of egg, bile, albuminous substance, or, what is best, a solution of alkali, composed of five to ten parts of alkali for every 100 parts of oil, at the same temperature, agitating the whole for some time to bring the fatty matter into a globular condition. If at this stage the action of the alkali is continued and the temperature is raised to 140°, it is found that intead of the fatty matters requiring a long time to saponify (as is usual even at a temperature of 212°) the saponification is most rapid, because each globule of fatty matter offers an immense surface to the action of the alkali, and it is found that in two or three hours the whole of the fatty matters are converted into soap. In fact saponification is so perfect that the mass of soap dissolves completely in water; and if the purpose is to liberate the fatty acids, this can be done at once by the addition of a little vitriol. The fatty acids produced by this comparatively cold saponification are so pure that when subjected to pressure the solid fatty acids have not the slightest odour and fuse at the point of 138°. As to the oleic acid prepared by this process, instead of being brown (as is usual with the commercial acid) it is colourless, and can be employed in manufacturing soap of good quality. When M. Mouries desires to make soap with the entire fatty matter, he acts at once upon the globular fatty mass, by adding salt, which separates the soap from the aqueous fluid; it is then melted and run into moulds. Whilst speaking of the mode in which alkalies can be made to act upon fatty matters, I ought to state that M. Pelouze observed the curious fact that large quantities of fatty matters could be split into their respective elements, viz., fatty acids and glycerine, by heating them for some hours with a small quantity of soap. This discovery of his, as we shall presently see, has been taken advantage of in the manufacture of stearic candles.

Permit me to state that *soft soaps* differ from hard soaps mainly in the substitution of potash for soda, and in the omission of the salting and clarifying processes, so that the soapy mass is not separated from the excess of water, and therefore after the fatty matter has been saponified by the alkali, the whole is evaporated to the required consistency. I cannot conclude better this hasty and imperfect sketch of the soap manufacture than by the following table of compositions, showing the per centages of the various elements in the following soaps:—

Names of Soaps.	Fatty acids.	Alkali.	Water.
Curd	62	6·0	32·0
Marseilles	60	6·0	34·0
White	60	6·4	33·6
White cocoa	22	4.5	73·5
Yellow rosin	70	6·5	23·5
Calico printers	60	5·2	34·8
Silk boiling	57	7·0	36·0
Wool scouring	55	9·0	36·0
Soft	43	10·0	47·0
Theoretical	63	6·4	30·6

As it is easy to introduce into soaps a much larger quantity of water than they should contain to render their employment economical, it behoves those who use large quantities in their manufacture to ascertain the extent of the moisture contained in soaps. This may be pretty accurately approximated to by placing a quarter of an ounce, divided into thin shreds, upon a hob or other warm situation, and leaving it for several days, when it will lose nearly the whole of the water it originally contained, or about a third of its weight if it does not contain an undue proportion. In many instances the proportions of alkali in soap may seriously affect its applicability. Thus I ascertained a few years since that the quality of soap best adapted to clear madder purples should not contain more than 5 per cent. of alkali, whilst for pinks, where it is necessary to remove any loose colour which the mordants may have mechanically retained, a more active soap is required, viz., one containing from 6 to 7 per cent. of alkali.

I have now to draw your attention to a totally different kind of manufacture, viz., that of composite, stearic, and Belmont candles. Many years elapsed between the scientific discovery by M. Chevreul of margaric and stearic acids, and their application to illuminating purposes, for it was early in 1825 that MM. Chevreul and Gay-Lussac took out a patent with a view of realising this advantage. But it was reserved for a manufacturer, M. de Milly, to perfect the manufacturing details of the processes, and to render these candles a marketable commodity. This he effected by also improving the manufacture of the wicks, and he was the first to introduce this article to the trade in 1832, under the name of *bougies de l'etoile.* Let me give you an idea of his *modus operandi.* 100 lbs. of tallow, 17 lbs. of lime previously slacked, and 1000 lbs. of water were placed in a large iron boiler, and kept at the boil for several hours by means of a jet of steam. The result was that the glycerine dissolved in the water, whilst the fatty acids united with the lime. The insoluble stearate, oleate, and margarate of lime were then decomposed by weak vitriol, under the influence of heat. Insoluble sulphate of lime was produced, and the fatty acids liberated. These, in their turn, were submitted to hot and cold pressure, which liberated the oleic acid, leaving the solid stearic and margaric acids behind; it was then only necessary to cast them into moulds containing wicks, and the *bougies de l'etoile* were produced. MM. de Milly and Motard have introduced, of late years, several important improvements into this branch of manufacture, the most important of which is that of operating under pressure, by which means they succeed in decomposing the fatty matters with 3 or 4 per cent. of lime instead of 17, this of course involving the saving of a large quantity of vitriol. M. Bouis has made a further improvement, by adding to stearic candles 3 or 4 per cent. of sebastic acid, which is extracted from castor oil, and has the high fusing point of 261°. M. Chevreul also suggested a simple method of increasing the whiteness of these candles, by the addition of a small quantity of ultramarine blue to neutralise the slightly yellow tint of the manufactured acid. One of the greatest improvements in the manufacture of these candles is that carried out by Price's Candle Company; but before describing to you this beautiful process, as adopted by Mr. G. F. Wilson, at this company's works, allow me to state a few facts. Up to 1840 the best kind of candles were those made of spermaceti or of animal fatty matters which were cold and hot pressed. In that year Mr. Wilson, whilst experimenting with the view of making candles which would not require snuffing, for the illumination on the occasion of Her Majesty's marriage, discovered that a combination of cocoanut stearine with stearic acid would make candles giving a beautiful light, and free from the necessity of snuffing. These he called "composite," and they were soon largely sold. In 1838 Mr. Fremy published his interesting discoveries, showing that when oils or fatty matters were mixed with 20 or 30 per cent. of concentrated sulphuric acid, the fatty matters were split, or, as he calls it, saponified, and that sulpho-margaric, sulpho-stearic, sulpho-oleic, and sulpho-glyceric acids were formed. He further observed that boiling water decomposed the sulpho-stearic and margaric acids, and only partially the sulpho-oleic into stearic, margaric, oleic, and sulphuric acids, which last acid remains in the water together with the sulpho-glyceric acid and that portion of the sulpho-oleic acid not decomposed, the other acids remaining insoluble and floating on the surface. In 1842 Messrs. G. Price and Jones secured a patent to carry out on a practical scale the scientific discoveries of M. Fremy. In that patent two or three important facts are brought out; first, that if instead of operating at a low temperature, as recommended by Fremy, heat was employed, the action of the sulphuric acid on the organic compounds would give rise to sulphurous acid, which they discovered had the remarkable property of converting the liquid oleic acid into a solid acid called "elaidic," thus largely increasing the yield of solid fatty acids. Their mode of operating was this—10 or 12 per cent. of concentrated sulphuric acid was added to the fatty matters which had been previously liquefied by heat, and the whole was kept at a temperature of 200° for 24 hours. During that time the fatty matters were split into their primitive elements, and the oleic acid was converted into elaidic acid. The whole was then repeatedly treated with boiling water, to dissolve the sulpho-glyceric acid and other impurities, leaving the solid fats ready for distillation. Mr. G. F. Wilson has since then greatly improved this part of his manufacture, as the beautiful candles, everywhere to be seen, will amply prove. The most important improvement in a chemical point of view is the following: He has found, for example, that fatty matters are split up into their component parts, by decreasing quantities of vitriol, as the temperature used is increased. Thus at a temperature of 200° 15 parts of vitriol are required; at 350°, 6 parts; at 500°, 1 part. Further, by employing this small proportion of sulphuric acid, not only is the expense of washing the fatty matters after their saponification by the acid avoided, but the distillation may be proceeded with in the same vessel. The distillation of fatty matters, first performed by Mr. Wilson, and since carried by him to a state of perfection, is based on the fact that, whilst fatty matters, if distilled by direct heat, are completely decomposed, giving rise to the noxious vapours of acroline, from the destruction of the glycerine, &c., this evil is completely avoided in distilling them by passing a current of superheated steam at a temperature of between 550° and 600° through the mass of melted fatty matters previously brought to the same temperature. By this means the glycerine passes first without decomposition, and is then followed by the fatty acids. In fact, the distillation proceeds with such rapidity and regularity that a stranger might witness the distillation of 1,000 gallons in 24 or 36 hours, and all the time would probably suppose that water only was distilling. The results are so perfect, that the Jury at the Paris Exhibition of 1855 could hardly credit their genuineness, and actually deputed Mr. Warren de la Rue to come from Paris to verify the fact that the beautiful products exhibited were obtained in many instances from very inferior kinds of fat. The glycerine only requires redistillation to be fit for all the purposes to which it is applied. As to the acids, they are submitted to an intense cold pressure, which separates the oleic acid from the stearic, margaric, or palmitic acids. These are melted, and when near the point of solidification, the vessel containing them is run on rails over the moulds, which are so arranged that each frame contains 200 separate moulds, in which already the wicks, prepared with borax or a salt of ammonia are fixed. The only remaining operation is to fill the moulds and allow the candles to cool.

Oleic acid has recently been made available for several valuable purposes; it has been largely employed in the manufacture of soap; but its most important application as yet is its use on the continent, and recently in England, as a substitute for olive oil in the greasing of wool for spinning, the advantages of which are marked, as its removal by alkalies in the scouring process is much easier, and its price lower. Messrs. Laing and Wilson have recently taken out a patent for the employment of oleate of ammonia as a mordant; and, as the specimens which I have the pleasure to show you illustrate, it increases in a marked manner the beauty and brilliancy of the coal-tar colours on cotton.

It now only remains for me to refer to another interesting process for splitting fatty matters into their elements, I mean that of Mr. Tilghman, which consists in mixing fatty matters with one-third to one-half of their bulk of water, and placing them in a vessel capable of resisting a very high pressure. There they are submitted to a temperature of between 550° and 600° Fahr., and under the influence of that heat and pressure the fatty matters are decomposed into glycerine and fatty acids. M. Tilghman has also adapted an apparatus which enables him, by means of coils of tubes, to keep up a constant stream of fatty matters and water through the tubes, surrounded by fire, by which means the decomposition is rapidly and continuously carried on. I must not, however, conclude this part of my lecture without drawing your attention to these beautiful specimens illustrating the manufacture of Messrs. Price and Co., kindly lent to me by Mr. G. F. Wilson.

Spermaceti.—This valuable substance is found in large quantities in the bony receptacles of the head of the white whale of the South Seas, and as it is there mixed with a fluid substance called sperm oil, these are separated by means of filtration. The solid mass which is thereby left in the linen bags is first pressed cold, and then between heated plates (hot-pressed). It is then physicked or heated in a boiler with a solution of caustic potash of sp. gr. 1·45, which dissolves a small amount of oily matter, still adhering to the spermaceti, and this, after being well washed, is run into moulds to cool. The manufacture of spermaceti candles requires great care and practical experience. The only fact I shall mention is, that about 3 per cent. of wax is added to spermaceti to prevent the mass being too crystalline or brittle. M. Chevreul, who chemically examined pure spermaceti, or cetine, at the beginning of this century, succeeded in unfolding it into an acid, which he called ethalic acid, very similar to palmitic, and into a neutral substance called ethal, the composition of which he prognosticated would be found to contain pure alcohol. This, I am pleased to say, has proved to be the case, for its composition can be considered as represented by—

$$C_{32} H_{33} O_3 + HO.$$

Mr. Heintz has recently published a very elaborate paper on the composition of this substance, and states that spermaceti contains the following components:

			Ethal or oxide of cetyle.
Stearophanate	$C_{36} H_{35} O_3$	...	$C_{32} H_{33} O_3$
Margarate	$C_{34} H_{33} O_3$	...	"
Palmitate	$C_{32} H_{31} O_3$	...	"
Cetate	$C_{30} H_{29} O_3$	...	"
Myristate	$C_{28} H_{27} O_3$	...	"
Create	$C_{26} H_{25} O_3$	...	"

It appears to me that several of these products do not exist ready formed in spermaceti, but are the results of chemical reactions.

Bees' Wax.—I have already had the pleasure, at the commencement of this lecture, of drawing your attention to the fact that bees either gather wax from the flowers on which they alight, or are capable of producing it direct from saccharine matters. The wax as it is obtained from the honeycomb being coloured it is necessary to bleach it for most of the applications which wax receives. The old process (still followed in many parts of Europe) consists in melting wax in water and allowing it to run into a second vessel so as separate it as completely as possible from its impurities. When cooled to nearly its melting point, it is allowed to fall on rollers which revolve in cold water, by which means thin ribbons of wax are obtained, which are then placed on meadows to bleach under the influence of the atmosphere. The above operations are repeated until the wax is perfectly bleached. This plan is so tedious and expensive that several chemical processes have been proposed. Mr. Casseraud's is to pass steam through the melted mass, which is at the same time subjected to the influence of sun light. Mr. Solly's is to treat the melted wax by a mixture of nitrate of soda and sulphuric acid, when the nitric acid liberated oxidises and destroys the colouring matters of the wax.

Pure wax melts at 149°, and, when treated with alcohol, is found to be composed of—

Cerine or Cerotic acid..	$C_{54}H_{53}O_3$ HO ...	65
Myricine	$C_{92}H_{92}O_4$ ...	30
Ceroleine	...	5
		100

Sir Benjamin Brodie, who examined most minutely the chemical composition of a great variety of waxes, considers that the substance called by chemists cerine is really cerotic acid, and that myricine is a compound of palmitic acid and melissine. The lecturer here illustrated and explained the various adulterations of wax, giving the means of detecting them. The adulterations were common owing to its value.

Chinese wax is a compact substance, imported from China, and said to be secreted by an insect called *Coccus Pela sinensis*. This wax, which is harder and more brittle than bee's wax, melts at 181°, and has yielded, in the hand of the above eminent chemist, cerotic acid and ceretine or oxide of cerotyle.

ON THE MANAGEMENT OF STEEL.

(*Continued from page* 301)

Tempering of Steel.

"A rod of good steel, in its hardest state, is broken almost as easily as a rod of glass the same size, and this brittleness can only be diminished by diminishing its hardness. In this management consists the art of tempering. The colours which appear on hardened steel, previously brightened, are, a light straw colour, a dark straw, gold colour, brown, purple, violet, and deep blue; these colours appear in succession as the hardness gets reduced. There are various ways of tempering steel, dependent upon the nature of the articles, likewise the quantity of them, for, in a number of instances, a great many articles may be tempered as expeditiously as a single one. To temper any article to colour it must be brightened after it is hardened, and then laid on a plate of hot iron, or upon the surface of melted lead, or in hot sand, or burning charcoal, or held in the centre of an ignited iron ring, or in the mouth of a furnace, or on a gas stove made for the purpose. But in constructing a furnace for hardening with, it is a good plan to have the top of the furnace made with a good stout plate of cast-iron, so that the plate will always be hot, and ready to temper anything that can be done on a plate; and it will do to put the sand on, and for many other useful purposes, especially if the plate be moveable, and a small opening left in the front of the furnace from the top down to the mouth, just to admit the tongs. If at any time hot lead is required the plate can be removed, and the pot of lead placed in the furnace, the plate can then be put back into its place. The opening in the front will be very convenient for getting the articles into the lead, and when the opening is not required it may be stopped with a piece of sheet-iron. With a furnace of this description it is surprising the amount of hardening and tempering that can be accomplished; for large things take a considerable time in heating, and while the hardener is waiting for them getting hot he may be engaged tempering on the top of the furnace, and still have his attention on the other articles. In the way of case hardening, a man's sole attention is not required on the articles all the time they are in the fire, as many things lie for hours before they are ready to put in the water, and he may then be engaged in tempering; but if this plate should prove too hot for small articles, another piece of plate may be laid on the top of it, and the articles laid on the top plate. It is not every one, however, that has large quantities to temper, so as to require a furnace or tempering stove; but merely a few articles occasionally, such as hobs, taps, dies, drifts, rimers, chases, drills, &c., for the use of the shop, in such cases the use of the furnace can be dispensed with; for a small quantity they may be heated in a common smith's fire, and hardened in the usual way: taps may then, after they are brightened, be held inside of an ignited iron ring till a dark straw colour appears on the surface, and then plunged into cold water; this is the best temper for general use, but if it is intended for any express purpose, for cutting things that are extra hard, in such cases a light straw colour or yellowish white will be required. Hobs require to be a yellowish white, for as they are always required for cutting steel, it is necessary they should be hard; fluted rimers may be held inside of an ignited ring, and tempered to a light straw colour. Dies may be hardened in the usual way, and when brightened, placed on a cold plate of iron, and the plate and the dies put upon a large piece of ignited iron, and tempered to the same colour as a tap—a straw colour. Chasers may be hardened in the usual way, and placed upon an ignited bar, keeping the threads some distance off the bar, and tempering to a light straw, or yellowish white. Drills may be hardened in the usual way, and the cutting part of the drill tempered to a straw colour, while the rest is not higher than blue, so that its liability to break when in use is greatly diminished. Chisels may be hardened in the usual way and tempered to a violet colour; but if intended for cutting stone, a purple is required. Drifts may be hardened in the usual way, and tempered to a brown colour. Milling cutters may be hardened in the usual way, and tempered to a yellowish white. Saws may be hardened in the usual way, in which state they will be brittle and warped: they may then be put into a proper vessel, with as much oil or tallow as will cover them, and placed over a fire and boiled to spring temper, or they may be smeared with tallow, and heated, till thick vapours arise and burn off with a blaze; they must then be hammered flat, and afterwards blued. But if they are intended for cutting hard substances, such as steel, or iron, they must be tempered to a straw colour.

A very convenient way of tempering when there is a large quantity of articles to do, is to place them in a vessel with as much tallow or oil as will cover them, and place them over a slow fire till a sufficient heat is given for the temper required. When the oil or tallow is first observed to smoke, it indicates the temper called straw colour, and when the smoke becomes more abundant, and of a darker colour, this indicates a temper equal to a brown; after which it will yield a black smoke, and still more abundant; this indicates a purple, after which it will take fire if a piece of lighted paper be presented to it, but not so hot as to burn when the light is withdrawn, and this is equal to a blue temper. The next degree of heat will be that which is mostly used for springs, when a white flame will be seen to burn on the articles if they are lifted out at this heat, after which the oil burns away. To add further oil is useless; any single article may be smeared with tallow, and held over a fire, or in a gas flame, and its temper known in a similar manner. For springs, if they are very slight, oil is the best to harden them in, as they are not so likely to draw out of the proper shape; but if they are stout springs, water is best, for in hardening a stout spring in oil, the hardness is confined to the surface; for if the springs are properly hardened, and the steel good, and boiled in oil to the temper I have stated, there is no failing in them. Solid tallow is better than oil for hardening steel, which requires considerable hardness, but must not be made brittle. Tallow differs from oil in the absorption of heat for its fusion, for steel that is hardened in oil has always a covering of coal round it which greatly retards the transmission of heat. Water holding soap in solution produces a similar effect; any large piece of steel may be made sufficiently hard to wear well in machinery without making it brittle by hardening in the body of solid tallow. A great many young mechanics are quite ignorant as to the nature of boiling oil, or tallow, and are anxious to try the experiment of tempering springs in boiling oil; to those I wish to say a few words. I was once asked by a young man the way to harden and temper springs, and I informed him to harden them first, and if he had a quantity to do, to temper them in boiling oil, never thinking that he would attempt to do them on the fire in the house, and the result was that he nearly set the house on fire. I have just mentioned this circumstance merely as a warning to the inconsiderate, that they may not fall into the same error. They must not attempt to boil oil unless they have a place suitable for it.

Expansion of Steel.

It is a well-known fact among those who are in the habit of hardening, that the hardening of steel increases its dimensions; still there may be some that have had very little to do with it, that may yet be ignorant of it, therefore it may be useful to acquaint those with it. The amount of this expansion cannot be exactly stated, for it varies in different kinds of steel, and even in the same steel operated upon at different heats. This expansion is in some measure reduced in tempering, but not to the size in which it was before it was hardened. The expansion is greatest where the steel has been heated to a high degree before dipping it in the water, which may in some measure account for the brittleness of the steel when over-heated. But this expansion can be prevented in a great measure, by annealing the steel about three times before the article is completely finished; for instance, when the first skin is taken from the steel it should be annealed again and then another cut taken from it and annealed again, and so on for the third time. I have found that articles treated this way will always keep their size better in hardening, than if the steel were only annealed once. This may appear to some to be a deal of trouble, but they will find there is a saving in the end, for hardened steel is very difficult to work, and the working of hardened steel is unknown to a great number of people, and many that know how to work on it, have not things convenient for it, such as buffs, laps, or stones; therefore, to keep the article as near the proper size as possible is a matter of importance. I have had articles that have only been annealed once, that have taken many hours to lap to the proper size after hardening, and I have had articles of the same kind, and from the same steel, and hardened at the same heat, that have been annealed three times, that have scarcely required to be touched after they have been hardened.

Annealing of Steel.

In the annealing of steel the same care is required in the heating of it as there is in heating it for hardening, for over-heating the steel is as injurious in one case as in the other. In the process of annealing artists differ very much, some approving of heating the steel and burying it in lime, some of heating it and burying it in cast-iron borings; while others approve of heating it and burying it in saw-dust. A far better plan is to put the steel into a box, made for the purpose, and fill it with charcoal dust, and plug the ends up so that the air is kept from the steel, then to put the box and its contents into the fire, till it is heated thoroughly through, and the steel is at a low red heat; it must then be taken from the fire, and allowed to remain in the box, without opening the box till the steel is cold. Then when taken out the steel will be nice and clean and very soft, and without those bright spots which some mechanics call pins, and which are no small impediments to the filing and working of steel, and, if any difference, the steel is improved by the process. A piece of stout gas pipe, with a bottom welded in, and a plug made for the other end, makes a very good box for a small quantity of steel; but, for a large quantity, the box must be large in proportion. If the steel is very large it is as well to make a charcoal fire to heat it in, and then let the steel and the fire get cold together before it is taken out, and it will be equally soft. But it sometimes happens that a piece of steel is wanted in a hurry, and the steel, perhaps, is too hard to work on, and cannot wait for its being softened in a box; in such cases it may be heated in an open fire, and buried in charcoal dust till it is cold, or if it be heated to a red heat sufficient to be seen in a dark place, and then plunged into cold water, it will work more pleasantly; but not so soft as if it were heated in a box with charcoal. There are many that do not know the value of a good tool, because the steel they work on has never been properly annealed, and before the tool has half done its duty it is worn out, or wants repairing: whereas, if the steel had been properly annealed, the same tool might have lasted ten times as long, without repairing.

Case-hardening of Iron.

Case-hardening is an operation much practised, and of considerable use, and in this art there are many different opinions. The prussiate of potash renders iron nearly as hard as steel, by simply heating the iron to a red heat, and putting the potash on it, and plunging it in cold water, but this hardness is confined to the surface. But the greatest effect may be produced by an air-tight box and animal carbon alone,—such as horns, hoofs, or leather, just sufficiently burnt to admit of being reduced to powder, in order that more may be got into the box with the articles. Bones reduced to dust will answer the same purpose. The articles intended to be case-hardened are put into the box with animal carbon, and the box made air-tight by luting it with clay; they are then placed in the fire, and kept at a light red heat for any length of time, according to the depth required; in half-an-hour after the box and its contents are thoroughly heated through it will scarcely be the thickness of a six-pense; in an hour, double, and so forth, till the desired depth is required. The box is then taken from the fire, and the contents emptied into pure cold water; they can then be taken out of the water and dried to keep them from rusting, by riddling them in a sieve with some dry saw-dust, and they are then ready for polishing. Case-hardening is a superficial conversion of iron into steel; but it is not always merely for economy that iron is case-hardened, but for a multitude of things it is preferable to steel, and answers the purpose better. Delicate articles, to keep them from blistering while heating, may be dipped in a solution of salt, and while wet also dipped into a powder of burnt leather, or bones, or other coaly animal matter.

On the Shrinking of Steel.

As a slight mistake at times is the common lot of all, a few words will not be out of place upon the shrinking of such pieces of work as the mechanic may have had the misfortune of boring too large, and which would be useless but for the process of shrinking it smaller. Shrinking is simply heating the steel and plunging it into cold water, but should it not prove small enough the first time, the operation must be repeated, and if insufficient the second time it must be operated upon the third time, which generally effects the purpose. After the third time, I have generally found the hole to cast either oval or bell-mouthed, but after shrinking it the third time, and the article still remaining a waster, there is another source open, which is simply to heat it again, and dip it in the water half-way, leaving one half of it above the water, and then to heat it again and dip in the reverse way, half-way in the water; this will often accomplish what other methods have failed to do. Small holes will shrink rather more if the hole be filled with loom; shrinking and expansion of steel vary so much, that I have, at a red heat, shrunk the hole in a steel ring considerably; and at a whitish heat on the same steel the hole has been considerably larger. Iron rings, or collars, may be shrunk after the same manner as steel, by simply heating and cooling in water.

Much might be said upon the various kinds of tools used in the turnery, but there is such a variety of them, differing in form and size, according to the necessities, it would take a whole volume to do them justice; some turners are apt to think the tools of their own invention best of any, and their attachment to them, not to say bigotry, is often occompanied with a silly attempt to conceal from their fellow-workmen the benefits of their amazing discoveries as to the best shape of a tool; but having had good experience in tools, and their different shapes, I give it as my opinion that the best shape of a tool is a tool that answers the purpose, does the work well, wherewith least steel is cut to waste in the dressing of it, least time required in the grinding of it, and whose wear is longest without repairing."

HEAT AND FORCE.

Whenever friction is overcome, heat is produced; and the amount of heat so produced is the exact measure of the force expended in overcoming the friction. Professor Tyndall says, while speaking upon the subject of "Heat Considered as a Mode of Motion:"—"We usually put oil upon the surface of a hone; we grease the saw, and are careful to lubricate the axles of our railway-carriages. What are we really doing in these cases? Let us get general notions first; we shall come to particulars afterwards. It is the object of the railway engineer to urge his train boldly from one place to another. He wishes to apply the force of his steam or his furnace, which gives tension to the steam to this particular purpose. It is not his interest to allow any portion of that force to be converted into another form of force which would not further the attainment of his object. He does not want his axles heated, and thence he avoids as much as possible expending his power in heating them. In fact he has obtained his force from heat, and it is not his object to reconvert the force thus obtained into its primitive form. For by every degree of temperature generated by the friction of his axle, a definite amount would be withdrawn from the urging force of his engine. There is no force lost absolutely. Could we gather up all the heat generated by the friction, and could we apply it mechanically, we should by it be able to impart to the train the precise amount of speed which it lost by the friction. Thus every one of those railway porters whom you see moving about with his can of yellow grease, and opening the little boxes which surround the carriage axles, is, without knowing it, illustrating a principle which forms the very solder of Nature. In so doing he is unconsciously affirming both the convertibility and the indestructibility of force. He is practically asserting that mechanical energy may be converted into heat, and that when so converted it cannot still exist as mechanical energy, but that for every degree of heat developed, a strict and proportional equivalent of locomotive force of the engine disappears. A station is approached say at the rate of thirty or forty miles an hour; the brake is applied, and smoke and sparks issue from the wheel on which it is pressed. The train is brought to rest: how? Simply by converting the entire moving force which it possessed at the moment the break was applied, into heat."

Horticultural Ink.

Copper, 1 part; dissolve in nitric acid, 10 parts; and add water 10 parts. Used to write on zinc or tin labels.

Lacquer for Brass.

Shellac, gamboge, dragon's blood, each 4 parts; saffron, 1 part; rectified spirits, 25 parts. Digest with heat and strain.

Machinery and Manufactures.

INTERNATIONAL COMPETITION OF FIRE ENGINES AT MIDDLEBURGH.

The report of the jury to the exhibition committee on the competitive exhibition of fire engines, held in Holland last July, has at length been published.

The jury give the following results of the trial of the steam fire engine of Messrs. Shand, Mason, and Co.:—

"At the trial the boiler was filled with water of the temperature of the atmosphere; 11 minutes elapsed between the moment when the fire was lighted (as shown by smoke issuing from the chimney), and that when there was steam of sufficient pressure to drive the water up the pump and thence to keep up the discharge of a powerful stream. The steam pressure gauge showed a variation of from 100 to 155 Eng. pounds upon the square inch. The pressure of the air within the air vessel varied according to the pressure gauge from 120 to 135 Eng. lbs. upon the square inch. The distance over which the largest quantity of water was thrown was found to be 45·4 metres. The time required for filling a tank of 8,000 litres was 6 min. 42 sec.; therefore the machine discharged 1,194 litres per minute.

The jury give the following results of the trial of the steam fire engine of Messrs. Merryweather and Sons:—

"This engine was tried in the same manner as the former, and was stoked with the same kind of coals. The water with which the boiler was filled was of the temperature of the atmosphere; 12 min. elapsed between the moment when smoke issued from the chimney and that when the engine was in full work, discharging the water in a powerful stream. The steam pressure gauge showed a variation of from 60 to 115 Eng. lbs. upon the square inch. The maximum pressure of the steam was not ascertained for a few minutes, when the regular working of the engine was interrupted. It was, however, then considerable. The pressure of the air within the air vessel varied from 90 to 95 lbs. The distance over which the largest quantity of water was thrown was found to be 35·95 metres. The time required for filling a basin of 8,000 litres was 7 min. 40 sec.; therefore this engine discharged 1,043 litres of water per minute.

"The canvas funnel which was placed over the tank to receive the stream of water had a diameter of nearly two metres. Its centre was 9·60 metres above the ground, and the horizontal distance from the delivery nozzle of the hose was 12·75 metres. The nozzle used for both engines was of the same diameter, viz., 32 millimetres (1¼ in.). The same kind of hose was used for ascertaining the distance and the quantity of water discharged by the engines.

"At the end of the trial of steam fire engines, we received a letter from Messrs. Merryweather and Sons, in which they ascribe the less favourable results with the engine which they had sent to a mass of salt particles that had remained in several parts of the engine, owing to a trial on the previous day, when the boiler had been filled with salt water; it was at the same time requested in that letter to be allowed a new trial. Yet this request was not complied with on our part. The importance of the matter has been a reason with us to make you acquainted with those particulars connected with the results of the competitive trial."

Sept. 3rd, 1864.

At a subsequent trial of Messrs. Merryweathers' engine, and Messrs. Shand and Mason's, conducted at Rotterdam on the 18th July, it is but fair to state that the following excellent results were then obtained, according to an official report from the Director of Public Works at Rotterdam to the Board of Local Works, and taken from observations made of the heights to which the water was projected, noted from minute to minute.

	M. & Sons.	S., M. & Co.
	ft.	ft.
Through a nozzle of 1¼ in. and 164 ft. of delivery hose, at an angle of 45 deg., over a wall 59 ft. high, during ½ hour	59	59
Through a nozzle 1½ in. and 246 ft. of delivery hose, vertically during ½ hour	90½	88½
Through a nozzle 1¼ in. and 285 ft. of delivery hose, vertically during ½ hour, the branch being placed 40 ft. high	111½	101½
After ¼ hour's working, orders were given to stop the engines for a few moments. On resuming work, Messrs. Shand, Mason, and Co.'s delivery hose burst, Messrs. Merryweather's, however, not being damaged.		
Through a nozzle of 1 1-8th in. and 400 ft. of delivery hose, vertically during ¼ hour	103	91½
With a short delivery hose, and a nozzle of 1 1-8th in., it was tried to throw water across the sloping roof of the cathedral, a height of 115 ft., the branch pipes being held at an angle of 25 deg. out of the perpendicular	Experiment successful.	Experiment *not* successful.

At the commencement of the experiment both engines had 10 lb. of steam in 5 minutes; 4½ min. later they had upwards of 60 lb., at which they commenced working. The steam and water pressures and strokes made by the engines, were taken every 5 min. The

	per sq. inch.	per sq. inch.
average steam pressure was	89½	126
" water pressure	92	95½
" strokes per minute	64½	164
	feet.	feet.
Vertical lift through suction hose	5·6	5·1

ECONOMY OF FUEL.

There are two branches to this important subject; the first is the complete combustion of the fuel, so as to generate all of the heat possible; and the second is to transfer the heat thus generated from the hot gases which are the products of combustion to the water or other substance to be heated.

The condition necessary to effect combustion is a temperature of about 1,000° above zero, and the contact at this temperature of each atom of hydrogen in the fuel with one atom of oxygen, and the contact of each atom of carbon with two atoms of oxygen.

Perhaps the best plan for realizing this condition yet reduced to practice is that employed in Roper's air engine. The fire is inclosed in an air-tight chamber, into which the air is forced by an air-pump, part below the grate and part above. The exit from this chamber is closed by a valve and opened at intervals, so that the air and the products of combustion are kept for some time mingled together in a close chamber where they are highly heated by the immediate presence of the fire. Under these circumstances it would seem hardly possible that a single atom, either hydrogen or carbon, could escape without coming in contact with oxygen. Could not this method be applied to furnaces of steam boilers?

The plans for getting the heat out of the gases are yet very imperfect. A certain portion must be lost. It is of course impossible, even in theory, to obtain any more of this heat than the surplus above the temperature of the water in the boilers. In practice the gases go away at a temperature far above that of the water. While the temperature of the water ranges from 260° to 360°, that of the escaping smoke and gases in the chimney ranges probably between 600° and 1,000°.

As every pound of oxygen in the atmosphere is accompanied by 3½ pounds of nitrogen, which performs no part in the combustion, but which absorbs and carries away heat, there is a loss in the introduction of more air than is necessary to complete the combustion. The quantity of air requisite in theory would be that which should contain just enough oxygen to combine with all of the carbon to form carbonic acid, and with all of the hydrogen to form water. But if only this quantity were introduced, it is not probable that the substances could be so mixed as to bring each atom of the carbon and hydrogen in contact with the atoms of oxygen. In practice, therefore, it is necessary to carry in a surplus of air, but it is important that no more should be carried in than is sufficient to secure complete combustion. It will probably be found, also, that there is a proper proportion to be introduced below the grate.

No plan has yet been devised by which an engineer of ordinary intelligence can ascertain whether the products of combustion are wholly carbonic acid and water; that is to say, whether the combustion is complete. If our chemists could furnish some simple test of the presence of carbonic oxide, and of the hydro-carbons in the chimney, they would make a valuable contribution towards the perfection of the steam engine.—*Scientific American.*

India-Rubber Packing.

Perhaps of all the improvements which the art of manufacturing india-rubber has undergone, none are more remarkable than those by which it has been rendered suitable for use in steam engineering. The days of the hemp gasket as a packing are fairly numbered, and in vulcanized india-rubber will be found a substitute better, under proper management, in every respect. We have already referred at some length to different systems of piston rod packing, and we would now wish to call attention to yet another, patented by the Messrs. Tuck. We strongly object to the indiscriminating praise too often awarded to new and untried inventions, but in this we have a system first experimented on years ago. We are constantly asked to recommend the "best packing," by correspondents. This we cannot do, but we can state that the packing to which we refer just now has borne the test of years, and that in consequence it is largely used by the Government, the Messrs. Penn, Maudlay, Rennie, and many of the largest steam shipping firms in the country. This should be quite sufficient for those who do not please to experiment for themselves. To such evidence in its favour we shall add but one word. After a tolerably close investigation, we have found that this packing gives such satisfactory results that we should feel no hesitation in adopting it under the most trying circumstances to which packing can be exposed.—*Mechanics' Mag.*

An English Atmospheric Hammer.

An atmospheric hammer and stamp is now being shown in operation in Birmingham, under the supervision of the patentee, Mr. Grimshaw, at 19½ Ryland street North, in that town. The way it works is as follows:—"An air-pump is worked by a band from a shaft, and forces air into a reservoir, which is so constructed as to form the framework of the machine. The reservoir, in its turn, communicates with a cylinder, in which a piston works with so little friction that it can be moved up and down by hand. This piston is, in fact, the hammer, inasmuch as at the end of it is fitted a head, which may be varied in form to suit any kind of work. The shaft, on which is fixed the pulley-wheel to which the pump crank is geared, has another wheel fitted upon it, which performs a very important operation. By means of a screw or lever (either will do), the last-named wheel can be so moved to or from the center of the revolving-plate, which is attached to the "cut off" valve, that the speed of the hammer can be varied entirely at the discretion of the operator. This wheel and plate work at right angles to one another, and when not in contact the hammer does not work. The reservoir is capable of bearing great pressure, and will store up, so to speak, a large amount of power, until it is wanted for a series of smashing blows. A valve attached to this reservoir prevents it bursting, and appears to be a valuable assistant means of regulating and variating the action of the hammer; and if it is true, as we have been assured, that these atmospheric hammers and stamps can be worked with much less power than steam stamps, costing less in the first instance, and cannot, from the simplicity of their construction cost nearly so much to keep in repair, there appears every probability of their coming into general use. The inventor is a practical mechanic, but the patent right has been sold."—*London Examiner.*

The errors of good men, an d the good deeds o bad men, should not be reckoned in our estimate of their characters.

Practical Memoranda.

Table

Of the Dimensions and Weight of Coppers, from 1 *to* 208 *gallons.*

The Dimensions taken from lag to brim.

Inches lag to brim.	Gallons.	Weight in lbs.	Inches lag to brim.	Gallons.	Weight in lbs.
9¾	1	1½	27	22	33
12¼	2	3	27¼	23	34½
14	3	4½	27½	24	36
15½	4	6	27¾	25	37½
16½	5	7½	28	26	39
17½	6	9	28½	27	40½
18½	7	10½	29	28	42
19½	8	12	29½	29	43½
20¼	9	13½	30	30	45
21	10	15	32	36	54
21½	11	16½	34	43	64½
22	12	18	35	48	72
22½	13	19½	36	53	79½
23¼	14	21	37	58	87
24	15	22½	38	63	94½
24½	16	24	39	67	100½
25	17	25½	40	71	106½
25½	18	27	45	104	156
26	19	28½	50	146	219
26½	20	30	55	208	312
26¾	21	31½			

Weight of Cast-Iron Plates, per superficial foot.

From one-eighth of an inch to one inch thick.

$\frac{1}{8}$ inch lbs. oz.	$\frac{1}{4}$ inch lbs. oz.	$\frac{3}{8}$ inch lbs. oz.	$\frac{1}{2}$ inch lbs. oz.	$\frac{5}{8}$ inch lbs. oz.	$\frac{3}{4}$ inch lbs. oz.	$\frac{7}{8}$ inch lbs. oz.	1 inch lbs. oz.
4 13$\frac{3}{8}$	9 10$\frac{5}{8}$	14 8	19 6$\frac{3}{8}$	24 2$\frac{3}{4}$	29 0	33 13$\frac{3}{8}$	38 10$\frac{3}{4}$

Force in Pile-Driving.

In a sandy soil the greatest force of a pile-driver will not drive a pile over fifteen feet.

Statistical Information.

Extension of Flax Culture in Ireland.

By the courtesy of the Registrar-General we are enabled to give the official and reliable statistics of the flax crop in Ireland for the present year. In the province of Ulster, the centre of the linen manufacture, the increase of the land under flax this year is 70,907 acres, one-third more than the average of 1863. In Munster the increase is 5, 438 acres, and the quantity sown is nearly four times as great as that of 1863. The increase in Leinster is 5,285 acres, and that of Connaught 6, 213 acres. The total increase for 1864 is 87,483, and the extent of the land actually under flax is 301,942 acres.—*Dublin Post.*

The Kingdom of Italy.

The Italian Government has just published the result of a census taken since the annexations which constituted it as it is at present. It contains some curious facts of which the accuracy cannot be doubted. The Kingdom of Italy contains a population of 21,777,334 souls. It is, consequently, the fifth Power in its inhabitants; Europe as regards superior to Spain, of which the territory is twice as extensive, and to Prussia, of which the area is likewise greater. Were the unity of Italy accomplished its population would amount to 27,000,000. The average population of a commune in Italy is 2,821 inhabitants, while the average in France is only 978 inhabitants. There are nine communes in 300 square kilometres. In France, on the contrary, there are 18 in a similar space. The population is most crowded in the south of the island of Sardinia; it is least numerous in the Marches and in the Æmilia. Italy contains on an average 84 inhabitants to the square kilometre—a figure higher than that of France or Prussia, but lower than that of England, Holland, or Belgium. Lombardy and Sicily are the provinces in which the population has increased most rapidly of late years. Sardinia and the Neapolitan province come next. The increase of population has been much slower in Piedmont. The wars of 1849 and 1859 have tended to that consequence.

Value of Pennsylvania Petroleum.

The petroleum produced in the State of Pennsylvania was sold at the well for $56,000,000 during the last twelve months, and the iron and coal of Pennsylvania only produced $51,000,000. In Philadelphia, the daily sales of petroleum stocks at the regular stock exchange board are over $200, 000. The number of petroleum companies organized is about 150, and in New York about 80.

Miscellaneous.

NINETEENTH ANNUAL EXHIBITION OF THE AGRICULTURAL ASSOCIATION OF UPPER CANADA.

Corrected list of Prizes awarded at the city of Hamilton, September 27, 28, 29 and 30, 1864, in the Arts and Manufactures Department.

PRIZE LIST.

CLASS XL.—Cabinet Ware and other Wood Manufactures.

Judges.—W. Bowman, London; W. Watt, Brantford; F. S. Clinch, Cobourg.

Cabinet Ware.

Best Centre Table, Jacques & Hay, Toronto, $8.

Best Drawing Room Sofa, do., do., $8.

Best Drawing Room Chairs, (set of) do., do., $8.

Miscellaneous.

Best Cooper's Work, Coridan Lewis, Dereham, $6.

Best Corn Brooms, 1 doz., Samuel Cann, Hamilton, $2; 2nd do., M. B. Beasly, Hamilton, $1.

Best Turning in Wood, collection of specimens, T. Miller, Toronto, $6; 2nd do., do., Lash & Co., Toronto, $3.

Best Turned Hollow Woodenware, assortment of, James Mills, Hamilton, $6; 2nd do., do., Henry Woolley, Hamilton, $3.

Best Veneers from Canadian Woods, undressed, W. Clements, Newbury, $8.

Best Wash-tubs and Pails, three of each, factory made, Coridan Lewis, Dereham, $4.

Extra Entries.

Ladder, A. Galloway, Bartonville, $4; Mangle, M. North, Brantford, $3; Moveable Comb Bee-hive, Peter A. Scott, Toronto, $2; Moveable Comb Bee-hive, combined Bee-palace and Hive, and Self-protecting Moveable Comb Observing Hive, J. H. Thomas & Brothers, Brooklin, $6; Surgical Fracture Bedstead, Thos. McIlroy, Brampton, $6; Three Clothes Horses, R. J. Shenot, Hamilton, $2; Champion Clothes Dryer, C. Vandusen, Wardsville, $2; Two Refrigerators, Jas. McKelvey, St. Catharines, $3; Piano Desks, Joseph Herald, Hamilton, $2; Clothes Dryer, Charles Jones, Trafalgar, $2; Sun Shades, assortment of, W. J. Lucas, London, $2; Machine Wrought Siding, specimens of, Anson Storms, Odessa, $2; Handscrews, collection of, Thos. Miller, Toronto, $2; Steam Coil Hoops for coopers' work, James Tomlinson, Thornhill, $2.

CLASS XLI.—Carriages and Sleighs, and parts thereof.

Judges.—Josiah Holmes, St. Catharines; M. O. Donovan, Whitby; James Kay, Galt.

Best Bent Shafts, half dozen, R. McKinley & Co., St. Catharines, $3.

Best Bows for carriage tops, 2 sets, R. McKinley & Co., St. Catharines, $3.

Best Buggy, double-seated, Thomas Macabe & Co., Hamilton, $10.

Best Buggy, single-seated, H. G. Cooper & Co., Hamilton, $8; 2nd do., do., do., $5.

Best Buggy, trotting, Thomas Macabe & Co., Hamilton, $6.

Best Carriage, two-horse pleasure, J. P. Pronguey, Hamilton, $12; 2nd do., H. G. Cooper & Co., Hamilton, $8.

Best Carriage, one-horse pleasure, Thomas Macabe & Co., Hamilton, $10.

Best Carriage Hubs, Rims or Fellows, and machine-made spokes, R. McKinley & Co., St. Catharines, $7.

Dog-cart, single horse, Thomas Macabe & Co., Hamilton, 2nd prize, $4.

Express Waggon, Thomas Macabe & Co., Hamilton, 2nd prize, $4.

Sleigh, one horse, pleasure, Samuel Lake, Newburgh, 2nd prize, $6.

Best Springs, one set carriage, William Robinson, Galt, $5.

Best Sulky, trotting, Wm. Robinson, Galt, $5; 2nd do., J. E. Anderson, Port Dover, $3.

Best Wheels, one pair carriage, unpainted, William Robinson, Galt, $4; 2nd do., Thomas Macabe & Co., Hamilton, $2.

Extra Entries.

Two-horse Dog Cart, William Robinson, Galt, $7; Hook and Ladder Waggon, Wm. Hunter, Brantford, $6; Spring Gig, J. E. Anderson, Port Dover, $4; Children's Carriages, J. Semmers, Hamilton, $4; Railway-car Seat, Sam'l Sharp, Hamilton, $4; Model Railway-car Truck, do., do., $4; Child's Carriage, E. Cooney, Brampton, $3; Machine for tenonting spokes of wheels, G. H. Meakins, Hamilton, a Diploma; Carriage or Velocipede, driven by hand power, E. R. Kent, Hamilton, $4; Cutter Stuff, the bendings, R. McKinley & Co., St. Catharines, $4; do., do., one bundle whole seat rails, bent, $2; Commercial Waggon, H. G. Cooper & Co., Hamilton, $4.

Report of Judges:—We, the undersigned, beg to recommend that in future the following classification be adhered to, viz: That covered vehicles be in one separate class, and that open or uncovered be in another separate class. We would also suggest that Lumber Waggons and Market Waggons be all embraced in Class XLI. with Carriages.

CLASS XLII.—Chemical Manufactures and Preparations.

Judges.—Dr. Howitt, Guelph; Jno. Winer, Hamilton; Dr. Beatty, Cobourg.

Best Essential Oils, assortment of, P. Irish, Brighton, $6.

Best Glue, 14 lbs., U. Bringer, Waterloo, $3.

Best Oil—coal, shale or rock, W. H. Gardner, Coal Oil Co., Hamilton, $6; 2nd do., Geo. White, Cedar Creek Oil Co., Woodstock, $4.

Best Resin, 30 lbs., Peter Irish, Brighton, $5; 2nd do., McConnell & Cotter, Hastings, $3.

Best Tar, 1 gal., Peter Irish, Brighton, $3.

Best Turpentine, Spirits of, 1 gal., Peter Irish, Brighton, $5; 2nd do., McConnell & Cotter, Hastings, $3.

Extra Entries.

Liniment, &c., James Kennedy, Hamilton, $2; Powdered Drugs, Kenny Bros. & Crathern, Montreal, $10; Pharmaceutical Preparations, Kenny Bros. & Crathern, Montreal, $5; Colours and Chemicals, Toronto Linseed Oil Manufacturing Company, $6 and a Diploma; Benzine, and Lubricating Oil, H. T. Bell, Oil Springs, $4; Adhesive Plaster, Peter Irish, Brighton, Commendation; Blacking, E. Dalley, Hamilton, $2; Black Ink, E. Dalley, Hamilton, $1; Prepared Medicines, E. Dalley, Hamilton, $2; Canadian Fire-proof Paint, A. H. Saul, West Williams, Middlesex, $6 and a Diploma; Assortment of Canadian Medicines, E. D. Campbell, East Flamboro, $2.

CLASS XLIII.—Decorative and Useful Arts, Drawings and Designs.

Judges.—G. H. Dartnell, Whitby; H. M. Melville, Hamilton; H. Langley, Toronto.

Best Carving on Wood, J. F. Peterkin, Toronto, $10; 2nd do., do., James Thompson, Hamilton, $6.

Best Decorative House Painting, George Waite, Hamilton, $6; 2nd do., do., do., John Orr, Toronto, $4.

Best Engraving on Wood, with Proof, McKean & Smith, Hamilton, $6.

Best Engraving on Copper, with Proof, John Ellis, Toronto, $6.

Best Geometrical Drawing of Engine or Mill-work, coloured, P. A. Peterson, Toronto, $6.

Best Lithographic Drawing, plain, W. C. Chewett & Co., Toronto, $6; 2nd do., W. R. Snow, Hamilton, $4.

Best Lithographic Drawing, coloured, W. C. Chewett & Co., Toronto, $6.

Best Mathematical, Philosophical and Surveying Instruments, collection of, A. F. Potter, Toronto, $15.

Best Modelling in Plaster, Moses Dow, Hamilton, $6.

Monumental Headstone, Day & McComb, Hamilton, 2nd prize, $4.

Best Picture Frame, ornamented gilt, John Alton, Hamilton, $5.

Best Penmanship, business hand without flourishes, William Bruce, Hamilton, $4; 2nd do., Bryant, Stratton & Day, Toronto, $2.

Best Penmanship, ornamental, Bryant, Stratton & Day, Toronto, $4; 2nd do., Miss Ruth Barnes, Saltfleet, $2.

Best Seal Engravings, collection of impressions, John Ellis, Toronto, $6.

Best Sign Writing, Geo. Booth, Toronto, $5; 2nd do., C. Bolingbrooke, Hamilton, $3.

Best Stained Glass, collection of specimens, J. McCausland, Toronto, $12.

Extra Entries.

Gold and Silver Leaf, C. H. Hubbard, Toronto, $4; and Dentists' Gold and Silver Foil, do., $4; Mantle Mirror, Marsden & Phillips, Hamilton, $5; Backgammon and Chess Board in one, F. S. Clinch, Cobourg, $4; Card Writing, plain and ornamental, Wm. Bruce, Hamilton, $2; Cheques from Engravings on Stone, Brown & Bautz, Hamilton, $4; Cheques, Frame of Lithographed, W. C. Chewett & Co., Toronto, $6; Shell Picture Frame, Charles Bright, Dundas, $2; China, Painted, Gilded and Finished, Hurd & Leigh, Toronto, $12 and a Diploma; Drawing Instruments, a set of, Geo. Matthias, Toronto, $10.

CLASS XLIV.—Fine Arts.

Judges.—David Murray, Guelph; J. D. Humphreys, Toronto; W. M. Wilson, Simcoe.

Professional List—Oil.

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

Best Historical Painting, Robert Whale, $12; 2nd do., Wm. N. Cresswell, Harpurhey, $7.

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

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

Best Marine Subject, Canadian subject, Wm. N. Cresswell, Harpurhey, $12; 2nd do., do., do., $7; do. Robert Whale, Burford, highly commended.

Best Portrait from Original Sittings, Robert Whale, Burford, $10; 2nd do., do., do., $6.

In Water Colours.

Best Animals, grouped or single, Wm. N. Cresswell, Harpurhey, $7; 2nd do., John H. Caddy, Hamilton, $5.

Best Flowers, grouped or single, John H. Griffiths, London, $7.

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

Best Landscape or Marine Painting, not Canadian subject, John H. Caddy, Hamilton, $7; 2nd do., Wm. N. Cresswell, Harpurhey, $5.

Best Marine View, Canadian subject, Wm. N. Cresswell, Harpurhey, $7; 2nd do., John H. Caddy, Hamilton, $5.

Pencil, Crayons.

Best Crayon, coloured, Miss H. N. Harrison, Hamilton, $6.

Best Crayon, plain, Richard Baigent, Toronto, $6.

Crayon Portrait from Original Sittings, Miss H. N. Harrison, Hamilton, 2nd prize, $4.

Best Pencil Drawing, Richard Baigent, Toronto, $6; 2nd do., Richard Baigent, Toronto, $4.

Amateur List—Oil.

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

Historical Painting, John H. Whale, Burford, 2nd prize, $5.

Best Landscape, Canadian subject, John H. Whale, Burford, $8; 2nd do., John H. Whale, Burford, $5; do. Miss Mary E. Campbell, Hamilton, highly commended; do. Miss M. Borland, Brantford, highly commended.

Best Landscape or Marine Painting, not Canadian, subject, Miss R. Barnes, Saltfleet, $8; 2nd do., do., John H. Whale, Burford, $5.

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

Portrait from original sittings, Mrs. A. Gillin, Brantford, 2nd prize, $5.

In Water Colours.

Best Animals, grouped or single, Wm. Ambrose, Hamilton, $7; 2nd do., Mrs. J. H. Roper, Hamilton, $5.

Best Flowers, grouped or single, D. Fowler, Emerald, $5; 2nd do., James Griffiths, London, $5; do., Mrs. Fitzgibbon, Toronto, very highly commended.

Best Landscape, Canadian subject, Wm. Ambrose, Hamilton, $7; 2nd do., D. Fowler, Emerald, $5; do., Mrs. Eliza Dixon, Hamilton, highly commended.

Best Landscape or Marine Painting, not Canadian subject, Wm. Ambrose, Hamilton, $7; 2nd do., Mrs. Eliza Dixon, Hamilton, $5; do., Mrs. Leggo, Hamilton, highly commended.

Best Marine View, Canadian subject, A. E. Walker, Hamilton, $7; 2nd do., R. Crockett, Hamilton, $5.

Best Portrait, from original sittings, D. Fowler, Emerald, $6.

Pencil, Crayons.

Best Crayon, coloured, Miss J. F. Dixon, Toronto, $5; 2nd do., James Gilbert, Toronto, $3; do., Miss J. S. Maughan, Toronto, highly commended; do., Mrs. A. McCallum, Hamilton, highly commended.

Best Crayon, plain, Miss J. F. Dixon, Toronto, $5; 2nd do., Mrs. A. Gillin, Brantford, $3.

Best Crayon Portrait, from original sittings, D. Fowler, Emerald, $5.

Best Pencil Portrait, from original sittings, D. Fowler, Emerald, $5.

Best Pencil Drawing, Allan Brough, Toronto, $5; 2nd do., do., Miss Bessie Gunn, Toronto, $3; do., special first prize, Miss E. Robertson, Colborne, Diploma and $5; do., D. Fowler, Emerald, commended.

Best Pen & Ink Sketch, Mrs. E. Gourley, Hamilton, $5; 2nd do., do., D. Fowler, Emerald, $3.

Best Photograph Portraits, collection of, in duplicate, one set coloured, R. Milne, Hamilton, $10.

Best Photograph Portraits, collection of, plain, Butler & Little, Cobourg, $8; 2nd do., do., R. Milne, Hamilton, $5; do., James Inglis, St. Catharines, highly commended; do., R. W. Anderson, Toronto, highly commended.

Best Photograph Landscapes and Views, collection of, R. Milne, Hamilton, $8; 2nd do., do., R. W. Anderson, Toronto, $5; do., D. C. Butchart, Toronto, highly commended.

Best Photograph Portraits, finished in oil, D. C. Butchart, Toronto, $8.

Extra Entries.

Canadian Figure Painting, Oil, W. R. Snow, Hamilton, $5; Sepia Drawing, R. Baigent, Toronto, $3; Original Painting in Water Colours and Photograph Portrait Painting in Water Colours, A. J. Cox, Cobourg, $4; Oil Painting, Fruit, W. Wright, St. Catharines, $3; Portrait, finished in Ink, Butler & Little, Cobourg, $3; Water Coloured Solar Camera Photograph, Jas. Inglis, St. Catharines, $5; Photograph Portraits, finished in Indian Ink, and Photograph Groups, out door, W. R. Anderson, Toronto, $4; Photograph, re-touched in Indian Ink, and enlarged Solar Photographs, finished in Indian Ink, D. C. Butchart, Toronto, $4; Sculpture, one piece, Samuel Gardner, Simcoe, Diploma and $8.

Report of Judges:—We have much pleasure in noticing that the Fine Arts Department this year is quite equal to, and, in some respects, superior to former years. We have still, however, to complain of a defective arrangement; many articles are consequently unnoticed, and much time is wasted in looking for pictures not placed in their proper sections.

We consider the practice introduced at this Exhibition, of affixing the name of the artist to his picture as extremely objectionable, and recommend its discontinuance.

CLASS XLV.—Groceries and Provisions.

Judges—A. McNaughton, Newcastle; Thomas F. Munn, Aylmer; E. Parker, Dundas.

Best Barley, pearl, 25 lbs., John Cox, Hamilton, $3; 2nd do., do., Robert King, Hamilton, $2.

Best Barley, pot, 25 lbs., John Cox, Hamilton, $3; 2nd do., do., Robert King, Hamilton, $2.

Best Biscuits, an assortment of, J. C. Chilman, Hamilton, $6.

Best Bottled Fruits, an assortment, manufactured for sale, Jeremiah Lyons, West Flamboro', $6; 2nd do., do., Nancy Hannon, Hamilton, $4.

Best Bottled Pickles, an assortment of, manufactured for sale, Jeremiah Lyons, West Flamboro', $6; 2nd do., do., Nancy Hannon, Hamilton, $4.

Best Buckwheat Flour, 25 lbs., Robt. King, Hamilton, $3; 2nd do., do., John McGregor, Nelson, $2.

Best Chicory, 20 lbs., prepared, George Pears, Toronto, $3.

Best Indian Corn Meal, 25 lbs., Robert King, Hamilton, $3; 2nd do., do., G. Davis, Wellington Square, $2.

Best Oatmeal, 25 lbs., W. Turner, Elora, Nichol, $3; 2nd do., do., John Stuart, Ingersoll, $2.

Best Soap, one box of common, C. Watts, Brantford, $4.

Best Soap, collection of assorted fancy, C. Watts, Brantford, $6.

Best Starch, 12 lbs. of flour, Petrie & Strowger, Newcastle, $2.

Best Starch, 12 lbs. of potato, do., do., $2.

Best Tobacco, 14 lbs., Canadian manufacture, F. Schwatz, Hamilton, $5; 2nd do., do., do., $3.

Best Wheat Flour, Harrison Brothers, Owen Sound, $7; 2nd do., do., do., $5.

Extra Entries.

Confectionery, an assortment, J. C. Chilman, Hamilton, a Diploma and $4; Split Peas, 25 lbs., Jas. Russell, Claremont, $2; Ground Spices, Kerry Brothers & Crathern, Montreal, a Diploma; British Arrow Root, a sample, Petrie & Strowger, Newcastle, a Diploma; Tallow Candles, C. Watts, Brantford, $2; Dandelion Coffee, George Pears, Toronto, $2; Vinegars, an assortment, S. B. Medley, Hamilton, $3; Farina, specimen of, John Cox, Hamilton, $2.

Judges' Report:—The Judges in Class XLV. beg to draw the attention of the Board to the manner the articles in this department are distributed throughout the building, instead of being found in one place, when there is ample room. The display is unusually small this year.

CLASS XLVI.—LADIES' WORK.

Judges—Miss C. White, Woodstock; Miss E. Addison, Galt; Miss Roberts, Dundas; Mrs. Kidner, Hamilton; Miss C. M. Stephens, Cobourg; Miss E. Cary, Paris.

Best Bead Work, Miss Eliza Jane Lyons, West Flamboro', $3; 2nd do., E. Carpenter & Co., Hamilton, $2; 3rd do., do., do., $1.

Best Braiding, Mrs. Bates, Hamilton, $3; 2nd do., Mrs. Colbeck, do., $2; 3rd do., Mrs. J. Inglis, St. Catharines, $1.

Best Crochet Work, Mrs. Wintermute, Hamilton, $2; 2nd do., E. Carpenter & Co., Hamilton, $2; 3rd Mrs. Wintermute, Hamilton, $1.

Best Embroidering in Muslin, Mrs. Williams, Hamilton, $3; 2nd do., Miss Harriet Bidwell, Cramahe, $2; 3rd do., Mrs. McKindrey, Milton, $1.

Best Embroidery in Cotton, Miss Silverthorne, Cooksville, $3; 2nd do., Miss Mary Ambridge, Hamilton, $2; 3rd do., Miss Stickle, Cobourg, $1.

Best Embroidery in Silk, Mrs. E. Carrigan, Hamilton, $3.

Best Embroidery in Worsted, Miss Johnston, Hamilton, $3; 2nd do., Miss Eliza Jane Lyons, West Flamboro', $2; 3rd do., Mrs. T. A. Young, Fergus, $1.

Best Gloves, three pairs, P. Hinman, Grafton, $2; 2nd do., Mrs. John H. Rutherford, North Dumfries, $1; 3rd do., Catherine Hancock, Hamilton, 50 cts.

Best Guipuire Work, Miss Eliza Jane Lyons, West Flamboro', $3; 2nd do., Mrs. Bates, Hamilton, $2; 3rd do., Miss Harriet Bidwell, Cramahe, $1.

Best Hair-work, Miss Anne Robertson, Colborne, $3; 2nd do., Mrs. H. P. Wilson, Caistor, $2: 3rd do., Mrs. John Breckon, Nelson, $1.

Best Knitting, Mrs. David Bates, Glanford, $3; 2nd do., Mrs. C. Miller, Norval, $2; 3rd do., Mrs. James Pole, Caledonia, $1.

Best Lace Work, Mrs. Manley, Toronto, $3; 2nd do., Miss Harriet Bidwell, Cramahe, $2; 3rd do., Miss Eliza Jane Lyons, West Flamboro', $1.

Best Mittens, three pairs woollen, M. D. House, Clinton, $2; 2nd do., P. Hinham, Grafton, $1; 3rd do., Julius Rouse, Brantford, 50 cts.

Best Needle-work, ornamented, Mrs. C. Miller, Norval, $3; 2nd do., Miss Eliza Jane Lyons, West Flamboro', $2.

Work, exhibited before, Mrs. Bates, Hamilton, Diploma.

Best Netting, fancy, M. Ashton, London, $3; 2nd do., Mrs. Holden, Guelph, $2; 3rd do., Miss Mary R. Hill, Kingston, $1.

Best Plait for Bonnets or Hats of Canadian Straw, Mrs. H. Stickle, Cobourg, $3; 2nd do., do., do., $2; 3rd do., Josh. Sutton, North Flamboro, $1.

Best Shirt, gentleman's, Miss Bennett, Cobourg, $3; 2nd do., Mrs. W. Mahaffy, Brampton, $2; 3rd do., Mrs. J. H. Rutherford, North Dumfries, $1.

Best Socks, three pairs of woollen, Mrs. G. Bennet, Cobourg, $2; 2nd do., Mrs. J. H. Rutherford, North Dumfries, $1; 3rd do., F. Teneyck, Binbrook, 50c.

Best Stockings, three pairs of woollen, Wm. Marshall, Barton, $2; 2nd do., Mrs. Dean, Hamilton, $1; 3rd do., Mrs. G. Bennett, Cobourg, 50c.

Best Tatting, Mrs. D. Powell, Cobourg, $3; 2nd do., Mrs. A. McGregor, Galt, $2; 3rd do., Miss H. Bidwell, Cramahe, $1.

Best Wax Fruit, Miss P. A. Callis, Hamilton Township, $6; 2nd do., Mrs. W. Bridgeman, Grimsby, $4.

Best Wax Flowers, Mrs. W. E. Welding, Brantford, $6; 2nd do., Miss Rowe, Whitby, $4; 3rd do., Mrs. Jas. Reilly, Fonthill, $2.

Wax Shells, collection, 3rd prize, Miss Rowe, Whitby, $2.

Best Worsted Work, Mrs. C. Farrell, Cayuga, $3; 2nd do., Mrs. A. McGregor, Galt, $2; 3rd do., Mrs James Johnson, London, $1.

Best Worsted Work, (fancy) for framing, Miss E. Lowell, Galt, $3; 2nd do., Miss E. J. Skinner, Hamilton, $2; 3rd do., Miss E. J. Lyons, West Flamboro, $1.

Best Worsted Work, (raised) Mrs. Bates, Hamilton, $3; 2nd do., Miss E. J. Lyons, West Flamboro, $2; 3rd do., Mrs. L. Hutchinson, Walsingham, $1.

Extra Entries.

Antimacassar, Miss A. Lyons, West Flamboro, $3; Silver Wire Flowers, Miss E. J. Lyons, do., $2; "Cordon" Pocket Handkerchief, Miss H. Bidwell, Cramahe, $1; Silk Quilt, W. Ramsey, Binbrook, $1; Farmers' Wreath, T. M. Rogers, Cobourg, $2; Cone Basket, Mrs. J. Reilly, Fonthill, $1; Cone Basket and Frame, Mrs. Egbert, Toronto, $3; Quilts, three, Mrs. John Cramm, Hamilton, $3; Wreath of Seeds, Mrs. Allen, Yorkville, $2; Berlin Wool Work, Miss Giles, Ingersoll, $2; Embroidered Handkerchief, Mrs. K. Robertson, Galt, $1; Cone Work, Mrs. Lottridge, Hamilton, $1; Shell Frames, Mrs. J. H. Roper, Hamilton, $2; Moss Pictures, Canadian Scenery, Mrs. K. Tully, Toronto, $2; Ladies' Bonnets, three, John Halbick, Galt, $3; German Dolls, two, Mrs. Jones, Yorkville, $1; Flower Wreath (dried) Mrs. J. D. Lafferty, Hamilton, $1; Paper Flowers, Mrs. Kerr, Hamilton, $2; Machine Sewing, Wanzer & Co., Hamilton, $1; Seaweed Basket, Miss Williams, Hamilton, $1; Cotton Stockings, ladies', Mrs. E. W. Pepper, Colborne, $1; Hearth Rug, Miss Rowe, Whitby, $1; "Lyre" of Everlasting Flowers, Mrs. Jas. Reilly, Fonthill, $2; White Quilt, Mrs. Wilson, Dixie, $1; Wreath of Wool and Silver Wire Flowers, Anson Stormes, Odessa, $3; Moss Wreath, do., do., $1.

CLASS XLVII.—MACHINERY, CASTINGS AND TOOLS.

Judges.—John Doty, Oakville; Charles Levy, Toronto; F. J. Rastrick, Hamilton.

Best Blacksmith's Bellows, James Dallyn, Hamilton, $4; 2nd do., J. Dallyn & Son, Hamilton, $3.

Best Edge Tools, assortment of, Galt Edge Tool Company, H. H. Date, Agent, $15.

Best Engine, steam, stationary, five-horse power and upwards, in operation, Geo. Northey, Hamilton, $25; 2nd do., F. G. Beckett & Co., Hamilton, $15.

Best Pump in Metal, D. S. Keith, Toronto, $6.

Best Refrigerator, D. S. Keith, Toronto, $6.

Best Saw Mill in operation, Waterous & Co., Brantford, Diploma and $6.

Best Sewing Machine, manufacturing, R. M. Wanzer & Co., Hamilton, $8.

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

Best Scales, platform, Gurney, Ware & Co., Hamilton, $5.

Best Scales, counter, Gurney, Ware & Co., Hamilton, $3.

Best Tools for Working Metals, assortment of, McKechnie & Bertram, Dundas, $12; 2nd do., W. H. Gibson, Dundas, $7.

Best Turning Lathe, McKechnie & Bertram, Dundas, $7.

Extra Entries.

Pricking and Setting Machine for manufacturing Card Clothing, Eyre Theurston, Ancaster, $10; Assortment of Card Clothing, Eyre Theurston, Ancaster, $4; Lot of Edge Tools, J. W. Robinson, Bridgewater, $5; Iron Planing Machine, W. H. Gibson, Dundas, $10; Brass Finishing Lathe, W. H. Gibson, Dundas, $2; Self-opening Gate, John & Daniel McFarlane, Etobicoke, $5.

One Fire-engine, William Marks, Toronto, $10.

Barrel-head Planer and Barrel-head Turner, Mair, Inglis & Co., Guelph, $4.

Shingle Sawing Machine, Mair, Inglis & Co., Guelph, $5.

Variety Moulding Machine, McKechnie & Bertram, Dundas, $4.

Improved Adjustable Self-feeding Boring Machine, James Vandyke, Grimsby, $8.

Empire Meat Chopper, Isaac A. Moyer, Clinton, $5.

Patent Cylinder Pump, J. James, Newmarket, $2.

Assortment Steam-pressure Guages, T. C. Collins, Toronto, $10.

Self-centreing Boxing Machine, for Carriage and Waggon Wheels, A. McCarter, Walkerton, $4.

Railway Locomotive Boiler, Cylinders, Engine Wheels, Crank Axles, Car Springs, Axle Boxes, Taps, Car Axle, Connecting Rods, &c., G. W. R. R. Works, by S. Sharp, superintendent, Diploma and honourable mention.

JUDGES' REPORT:—The judges in this class would recommend that Honourable Mention be made of the several articles exhibited by the Great Western Railway Company, as they evince enterprize on the part of the company, and superior skill on the part of the workmen; and they feel that they can not award any money prize that would be commensurate with the design and finish of the several articles exhibited—the judges also award a diploma.

CLASS XLVIII.—METAL WORK (MISCELLANEOUS) INCLUDING STOVES.

Judges—George Wales, St. Catharines; Robert Moore, Simcoe; Thomas Cowherd, Brantford.

Best Engineers' Brass Work, an assortment, D. S. Keith, Toronto, $8; 2nd do., Samuel Sharp, Hamilton, $6; do., T. S. Collins, Toronto, commended.

Best Fire-arms, an assortment, James M. Jones, Chatham, Diploma and $8.

Best Fire-proof Office Safe, J. & J. Taylor, Toronto, $8; 2nd do., Kershaw & Edwards, Montreal, $5.

Best Combination Bank-lock, Kershaw & Edwards, Montreal, Diploma and $8.

Ornamental Iron Work, from the hammer, James Berry, Wellington Square, second prize, $4.

Best Nails, 20 lbs., pressed, R. Juson & Co., Hamilton, $6.

Best Nails, 20 lbs. of Cut, R. Juson & Co., Hamilton, $6.

Best Plumbers' Work, an assortment, Malcolm & Anderson, Hamilton, $8.

Best Screws and Bolts, an assortment, Samuel Sharp, Hamilton, $6.

Best Tinsmiths' Lacquered Work, an assortment, Thomas R. Gilpin, St. Mary's, $6; 2nd do., D. Moore & Co., Hamilton, $4.

Stoves.

Best Cooking Stove, for wood, D. Moore & Co., Hamilton, $6; 2nd do., D. Moore & Co., do., $4.

Best Furniture, for Cooking Stove, one set, D. Moore & Co., Hamilton, $4.

Best Hall Stove, for wood, Hon. H. Ruttan, Cobourg, $5; 2nd do., D. Moore & Co., Hamilton, $3.

Best Parlour Stove, for wood, D. Moore & Co., Hamilton, $5; 2nd do., D. Moore & Co., do., $3.

Best Parlour Stove, for coal, D. Moore & Co., Hamilton, $5.

Extra Prize.

Two Spool Stands, and three Clam-shell Boxes, Matthews & Howles, Hamilton, $2; Cable, Trace and Log Chains, an assortment, Henry Schulte, Barton, $3; Nails, an assortment, R. Juson & Co., Hamilton, a Diploma; Curry Combs, an assortment, E. Burnham & Co., Toronto, $2; Drum Heater, M. North, Brantford, Diploma and $4; Parlour House-safe, J. & J. Taylor, Toronto. $2; Lightning Rod, George Kimball, Toronto, $2; Railroad Spikes, S. M. Gobel, Hamilton, $2; Door-spring and Hinge, combined, and Door-plate, with bell attached, C. S. Nickleson, Hamilton, $4; Duck Tea-kettle and Iron-heater, D. Moore & Co., Hamilton, $2; Model of a Locomotive Brass Dome, A. Frumviller, Hamilton, $4.

CLASS XLIX.—MISCELLANEOUS, INCLUDING POTTERY AND INDIAN WORK.

Judges.—Samuel Qua, Paris; Duncan McMillan, Dundas; W. H. Sheppard, Toronto; P. A. McDougall, Oakville.

Miscellaneous.

Best Brushes, an assortment, Alfred Green, Hamilton, Diploma and $6; 2nd do., Meakins & Son, Hamilton, $4.

Best Model of a Steam Vessel, Richard Osborne, Newburgh, $6; 2nd do., Samuel Symons, Hamilton, $4.

Best Model of a Sailing Vessel, James Heasley, Kingston, $6; 2nd do., Richard Osborne, Newburgh, $4.

Pottery.

Best Filter for Water, J. H. Ahrens, Paris, $3; 2nd do., W. & R. Campbell, Hamilton, $2.

Best Pottery, an assortment, W. & R. Campbell, Hamilton, $8; 2nd do., J. H. Ahrens, $5.

Best Sewerage Pipes, Stoneware, an assortment of sizes, W. & R. Campbell, Hamilton, $10; 2nd do., T. Nightingale, York Township, $6.

Best Stoneware, an assortment, F. P. Goold, Brantford, $10.

Best Slates for Roofing, Ben. Walton, Toronto, $8; 2nd do., J. J. Vickers, Toronto, $5.

Indian Work.

Best Buckskin Mittens, one pair, H. Y. Ferdinand, Waterloo, $2.

Best Moccasins, worked with beads or porcupine quills, one pair, Marie, Caughnawaga, $3; 2nd do., Louise, Caughnawauga, $2.

Extra Entries.

Model of Brick-kiln, W. Wagner, Montreal, a Diploma; Pleasure Boat, Pleasure Skiff, Oars and Paddles, W. O. Gorman, Kingston, $10; Glassware, Gatchell, Moore & Co., a Diploma and $6; Racing Skiff, Working Skiff, and set of Models of Boats, D. Phelan, Hamilton, $5; for Smoking Caps and Cushions, Holy-water Cups, Bead-bags, Comb-baskets, &c., &c., the sum of $32 was awarded in prizes to Indians from Caughnawauga, Cornwall, and St. Regis; Curling Stones, Robt. Carse, Hamilton, $2; Bricks, white and red, pressed, Daniel New, Hamilton, commended; do., Machine made Thomas Nightingale, York Township, commended; Model of a full rigged Ship, John Ross, Hamilton, commended; Lawn Vases and Hanging Flower Pots an assortment, W. & R. Campbell, Hamilton, commended.

CLASS L.—MUSICAL INSTRUMENTS.

Judges.—John Hilton, Hamilton; Herman Kordes, London; John Carter, Toronto.

Best Harmonium, R. S. Williams, Toronto, $10; 2nd do., Andrews Bros., London, $6.

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

Best Piano, square, C. L. Thomas, Hamilton, $15; 2nd do., John C. Fox, Kingston, $10.

Extra Entries.

Violin, Coridan Lewis, Dereham, $1; Church Organ, T. F. Roome, Toronto, a Diploma and $15.

CLASS LI.—NATURAL HISTORY.

Judges.—Professor Hincks, Toronto; Robert Algar, Brantford.

Canadian Birds, stuffed, named and classified, Thos. McIlwraith, Hamilton, 1st prize, $8.

Insects, collection of native, named and classified, Reginald Gourlay, Hamilton, 2nd prize, $6.

Minerals—Collection of Minerals of Canada, named and classified, W. P. Wright, Hamilton, 1st prize, $8.

Plants—Collection of native plants, arranged in their natural families and named, Miss E. R. Cary, 1st prize, Paris, $8.

Extra Entries.

Geological Specimens, foreign, W. P. Wright, Hamilton, $8; Collection of Singing Birds, W. Debus, Hamilton, $12; Collection of Singing Birds, Alex. White, Hamilton, $6.

CLASS LII.—PAPER, PRINTING, BOOK-BINDING, AND TYPE.

Judges.—Robt. Reid, London; W. Brown, Hamilton; J. Edwards, Toronto.

Best Book-binding, (blank book) assortment of, Dredge & Wilson, Toronto, $5.

Book-binding, (letter-press) assortment of, Richard Haigh, Hamilton, 2nd prize, $3.

Best Letter-press Printing, plain, George Brown, Toronto, $5.

Best Letter-press, Printing, ornamental, George Brown, Toronto, Diploma and $5.

Best Papers—printing, writing and wrapping, one ream of each, Jas. Buntin & Co., Hamilton, Diploma and $6.

Best Papers—blotting and coloured, one ream of each, Jas. Buntin & Co., Hamilton, $6.

Extra Entries.

Lovell's Series of School Books, John Lovell, a Diploma; Envelopes, assortment of, J. Buntin & Co., Hamilton, a Diploma; Mill Board and Straw Board, Mrs. C. Bansley, West Flamboro, Diploma and $2; Letter-press Printing, Ornamental Cards and Posters, George Brown, Toronto, commended.

CLASS LIII.—SADDLE, ENGINE-HOSE, TRUNK MAKERS' WORK AND LEATHER SADDLERY, &C.

Judges.—Duncan McKay, Brantford; Thos. Morrow, Cobourg; Hugh Cant, Galt.

Best Engine Hose and Joints, $2\frac{3}{4}$ inch diameter, 50 feet of copper rivetted, Wm. Marks, Toronto, $8; 2nd do., Wm. Inkson, Hamilton, $5.

Best Harness, set of double carriage, E. Kraft, Hamilton, $8; 2nd do., Wm. Inkson, Hamilton, $5.

Best Harness, set of single carriage, A. Fraser, Hamilton, Diploma and $7; 2nd do., E. Kraft, Hamilton, $4.

Best Harness, set of team, R. Malcom, Toronto, $5; 2nd do., Wm. Inkson, Hamilton, $3.

Best Harness, set of express, R. Malcom, Toronto, $6.

Best Hames, carriage or gig, best assortment, G. L. Campbell, Hamilton, $5.

Best Hames, team or cart, best assortment, Robert Malcom, Toronto, $5; 2nd do., R. C. Gill, Cramahe, $3.

Best Saddle, ladies, quilted safe, Wm. Thompson, Whitby, $6.

Best Saddle, gentlemen's plain shaftoe, Wm. Thompson, Whitby, $6..

Leather.

Best Belt Leather, 30 lbs., John Bartle, Chippawa, $4; 2nd do., George Sime, Dunnville, $3.

Best Brown Strap and Bridle, one side each, John Bartle, Chippawa, $4.

Best Deer Skins, three dressed, Henry Ferdinand, Waterloo, $3.

Best Harness Leather, two sides, John Bartle, Chippawa, $4; 2nd do., Robt. Lingwood, Fergus, $3.

Best Skirting for Saddles, two sides, John Bartle, Chippawa, Diploma and $4.

Extra Entries.

Scotch Collars, R. Malcom, Toronto, $2; Skate Leathers, R. Malcom, Toronto, $1; Scotch Collars, Ed. Leslie, Stratford, $2; Kay Collar, Ed. Brazenor, Hamilton, a Diploma; Prince of Wales Collar and Full Patent Collar, Ed. Brazenor, Hamilton, $3; assortment of Whips, G. H. King & Co., Hamilton, a Diploma; assortment of Whip Thongs, Isaac McMichael, Hamilton, $4; Leather, dressed in Russian manner, W. Wagner, Montreal, $2.

Judges' Report.—We find the assortment of Harness larger than in former years, and of an excellent quality. The Leather is good, but not so large in quantity as at former Exhibitions. The assortment of Whips is excellent, and very creditable to the manufacturers. The Silver-plated Gig and Carriage Hames, manufactured in Hamilton, are an excellent article, and ought to be encouraged. We would recommend two classes in future, for oak and hemlock-tanned leathers.

CLASS LIV.—Shoe and Bootmakers' Work, Leather, &c.

Judges.—Jas. Bain, Whitby; W. Wilson, Woodstock; W. A. Lindsay, St. Catharines.

Best Boots, Ladies', an assortment, A. Sutherland, Kingston, Diploma and $7; 2nd do., George Offord & Co., Kingston, $4.

Best Boots, Gentlemen's, sewed, an assortment, A. Sutherland, Kingston, $7.

Best Boots, pegged, an assortment, A. Sutherland, Kingston, $5.

Best assortment of Machine-made Ladies', Misses', Boys', Youth's and Children's Boots, ever exhibited in this province, R. Nisbet & Co., Hamilton, a Diploma.

Best Lasts and Trees, an assortment, Selway & Iredale, Toronto, $8; 2nd do., W. A. Young, Carlyle, $5.

Best Shoe Pegs, James Gladstone, Ayr, $4; 2nd do., W. A. Young, Carlyle, $3.

Best Calfskins, R. Garner, Stamford, $3; 2nd do., Clarke Snure, Louth, $2.

Best Grained Calfskins, R. Lingwood, Fergus, $3; 2nd do., John Bartle, Chippawa, $2.

Best Calfskins, two Morocco, R. Lingwood, Fergus, $3; 2nd do., John Bartle, Chippawa, $2.

Best Cordovan, two skins, R. Lingwood, Fergus, $3.

Best Dogskins, two, dressed, George Sime, Dunnville, $3.

Best Kipskins, two sides, R. Garner, Stamford, $3; 2nd do., John Bartle, Chippawa, $2.

Best Kipskins, grained, R. Lingwood, Fergus, $3 2nd do., R. Garner, Stamford, $2.

Best Sole Leather, two sides, U. A. Harvey, Chippawa, $3; 2nd do., R. Garner, Stamford, $2.

Best Upper Leather, two sides, R. Garner, Stamford, $3; 2nd do., John Bartle, Chippawa, $2.

Best Upper Leather, grained, two sides, R. Garner, Stamford, $3; 2nd do., Moore Bros., St. Thomas, $2

Extra Prizes.

One side Morocco Grained, R. Lingwood, Fergus, $2; do., Waxed Grained, do., do., $2; assortment of Elastic Webbing for Gaiter Boots, J. L. Lawder, Brockville, Diploma.

Judges' Report.—The Judges of Class 54 would recommend that an Extra First-class Prize be awarded to R. Nisbet & Co., wholesale manufacturers, Hamilton, for the best assortment of gentlemen's, ladies', misses, boys', youths' and children's Boots, Machine-made, ever exhibited in Canada; and also a Second Prize to Geo. Offord, Kingston, for men's machine-made coarse Boots; and also that a Diploma be awarded James Lawder, for a good assortment of Elastic Webbing for ladies' and gentlemen's Gaiter Boots, manufactured in Brockville.

CLASS LV.—Woollen, Flax, and Cotton Goods; and Furs and Wearing Apparel.

Judges.—John Kirkland, Aylmer; W. H. Glassco, Hamilton; W. Roberts, Dundas.

Best Blankets, woollen, one pair, Wm. Slingsby & Co., Ancaster, $6; 2nd do., do., do., $4.

Best Calico, unbleached, one piece, P. W. Wood, Montreal, $3.

Best Carpet, woollen, one piece, E. Snider, Brockville, $8.

Best Carpet, woollen stair, one piece, do., do., $7.

Best Casimere Cloth from Merino Wool, one piece, P. Hinman, Grafton, $7.

Cloth, fulled, one piece, John Soules, Saltfleet, 2nd prize, $4.

Best Counterpanes, two, John Nevill, Stratford, $5; 2nd do., Edmund Smith, Ancaster, $3.

Best Woollen Drawers, factory made, N. Walker & Sons, Campbellville, $5; 2nd do., J. G. Crane, Ancaster, $3.

Best Flannel, factory made, one piece, William Slingsby, Ancaster, $5; 2nd do., Robert Ellis, Ancaster, $3.

Best Flannel, not factory made, one piece, P. Hinman, Grafton, $5; 2nd do., J. McGregor, Hamilton, $3.

Horse Blankets, two pairs, Reuben Spooner, Kingston Township, 2nd prize, $3.

Best Kersey, for Horse Clothing, one piece, E. Snider, Brockville, $5.

Best Sheepskin Mats, dressed and coloured, Misses Lyons, West Flamboro, $6.

Best Shirts, factory made, three each, woollen and Angola, J. G. Crane, Ancaster, $5.

Best Stockings and Socks, factory made, woollen, three pairs of each, J. G. Crane, Ancaster, $4; 2nd do., do., J. G. Crane, Ancaster, $2.

Best Stockings and Socks, factory made, mixed woollen and cotton, three pairs each, J. G. Crane, Ancaster, $4; 2nd do., do., J. G. Ancaster, $2.

Best Suit of Clothes of Canadian Cloth, Lawson Bros. & Co., Hamilton, $8.

Best Winsey, checked, one piece, Thomas Govan, Nelson, $5.

Best Woollen Shawls, Stockings, Shirts and Mitts, J. G. Crane, Ancaster, Diploma and $10; 2nd do., E. Snider, Brockville, $6.

Best Yarn, white and dyed, one pound of each, J. G. Crane, Ancaster, $3.

Best Yarn, fleecy woollen, for knitting, one pound, J. G. Crane, Ancaster, $3.

Best Yarn, cotton, two pounds, P. W. Wood, Montreal, $3.

Extra Entries.

Scarf Shawl, home made, Francis Teneyck, Binbrook, $1; Hoop Skirts, Geo. D. Hawkins, Hamilton, $3; Scarlet Shawls, A. Bond, Storrington, $2; White Wadding, P. W. Wood, Montreal, $2; Batting, P. W. Wood, Montreal, $2; Sewing Machine Work, G. W. Folts, Toronto, $2; Fancy Winsey Petticoats, Thomas Swan, Nelson, $2; Deerskin Sack Overcoat, Robert Gallagher, Hamilton, $3; Suit of Fancy Doeskin, Lawson Bros. & Co., Hamilton, $2; Piece of Rag Carpet, Eliza A. Johnston, London, $3.

CLASS LVI.—Foreign Manufactures.

Judges.—J. T. Rykert, St. Catherines; Dr. Beatty. Cobourg.

Writing Copies and Text Books, Bryant & Stratton, N. Y., commended.

Door Bells, an assortment, Mr. Barton, East Hampton, Connecticut, commended.

Indellible Pencil for Marking Linen, Nellie M. Maguire, N. Y., commended.

Self Sewers, D. Barnum, N. Y., Diploma.

Ornamental Penmanship, Bryant & Stratton, N. Y., Diploma.

Cheese-making Apparatus, O. O'Neill & Co., Utica, N. Y., Diploma.

Oneida Cheese Vat, W. Ralph & Co., Utica, N. Y., Diploma.

Horse Hay Pitchfork, R. J. Blundell & Co., Chicago, Diploma.

Liquid and Soluble Dyes, J. T. Johnston, Saratoga, N. Y., Diploma.

The Magnesium Light.

The great difficulty which has hitherto stood in the way of the utilization of this light has been the want of some means for its easy application. This difficulty now appears to be very fairly surmounted. We have seen a very ingenious and simple lamp, the invention of a Mr. A. G. Grant, a Nottingham photographer, which effects the object in view very satisfactorily. The double wire is coiled on spools, and thence is drawn between cylinders to a tube, through which it is thrust at precisely the rate at which it burns by clockwork. Nothing can be more simple and effectual. The apparatus will form either a hand lamp or may be applied for other purposes, such as the lighting of theatres, the making of fog signals, or signals of any kind. The hand lamp will be especially useful for photographers. By its assistance they will be able to take portraits in less time at night by the magnesium light than they can now in the daytime by the sun. There is a variety of other purposes for which the light will be useful now that it can be readily applied. The increasing cheapness of the magnesium wire will soon cause it to be generally adopted in all cases where a most brilliant light is required, and the lamp invented by Mr. Grant will materially assist in its advancement in public favour.—*Mechanics' Magazine.*

A new light for Manufactories.

Professor Seely, of this city, has obtained a patent for an electric light on a principle which very strangely does not seem to have been thought of before as the best and by far the most economical mode of producing light by electricity. He employs the current generated by an ordinary frictional electrical machine, and obtains the light by interrupting the current. It has long been known that a very brillant and steady light might be procured in this way, but the objection to its use is the uncertainty in the action of the frictional machine. Dry air is a very poor conductor of electricity, and when a machine is excited in such an atmosphere the electricity will remain in tension for a considerable time. But moisture in the air conducts the electricity away, and when the moisture reaches a certain point the fluid is removed so rapidly that the machine will not work. Professor Seely's invention consists in devices for making the action continuous in all weathers. This is effected by surrounding the machine with a glass case, and keeping the air within the case dry by means of chloride of calcium or other hygroscopic substance.

It has been observed that when the conductor of an electric current is interrupted in a way to draw a spark across the break, the brilliancy of the spark varies with the material by which the conductor is terminated at the break. Professor Seely is now engaged in experiments to ascertain what material will produce the most intense light.

If the apparatus works according to anticipation a cotton mill may be lighted without any current expense, except the small power required to turn the electrical machines. As in mills driven by water there is always a surplus of power during the winter months, the only time when lights are required, there would be no expense for this light except the first cost of the apparatus, which would be quite moderate.—*Scientific American*.

Watt, the Inventor of the Steam Engine.

A young man, wanting to sell spectacles in London, petitions the Corporation to allow him to open a little shop, without paying the fees of freedom, and he is refused. He goes to Glasgow, and the Corporation refuse him there. He makes the acquaintance of some members of the University, who find him very intelligent, and permit him to open his shop within their walls. He does not sell spectacles and magic lanterns enough to occupy all his time; he occupies himself at intervals in taking asunder and remaking all the machines he can come at. He finds there are books on mechanics written in foreign languages; he borrows a dictionary and learns those languages to read those books. The University people wonder at him, and are fond of dropping into his little room in the evenings, to tell him what they are doing, and to look at the queer instruments he constructs. A machine in the University collection wants repairing, and he is employed. He makes it a new machine. The steam-engine is constructed; and the giant mind of James Watt stands out before the world —the herald of a new force of civilization. But was Watt educated? *Where* was he educated? At his own workshop, and in the best manner. Watt learned Latin when he wanted it for his business. He learned French and German; but these things were tools, not ends. He used them to promote his engineering plan as he used lathes and levers.—*Fincher's Trades' Review*.

Are Hurricanes Caused by Meteors?

Among the most mysterious actions of the atmosphere are those blasts of wind that sometimes rush along in narrow paths with terrific violence for a moderate period of time and for a moderate distance. May not these be caused by the passage of meteoric stones through the air?

The great meteor which passed over this city on the 20th of July, 1860, was seen at Elmira at five minutes before 9 o'clock in the evening; a friction of a minute later it flashed over this city; and in a few seconds it was lighting up the east end of Long Island, 90 miles away. It is supposed that the heat of these bodies is caused by the destruction of their motion from the resistance of the air, and that large numbers of them are so highly heated as not only to be melted, but to be evaporated, when they would of course be dissipated in the atmosphere. Would not one of these bodies, rushing at such immense velocity through the air, necessarily produce a narrow and violent blast of wind along its track, conforming in all respects to the singular hurricanes that so frequently occur?

If the earth should be stopped in its orbit, it would begin to fall straight towards the sun. As it approached more nearly to that great source of heat it would soon reach a point when the temperature is as high as 212°, and then all of the waters of the ocean would be evaporated. As it drew still nearer, the rocks would be melted, and afterwards they also would be evaporated. Before it reached the sun, this solid earth would be converted into a vast volume of red hot gas, which when it fell into the fiery atmosphere of the sun, would merely produce blasts of wind from the point where it struck outward in all directions.

A Cheap Dining-room for the London Workmen.

A commodious building has been erected and opened in Cambridge street, for the provision of cheap meals to workmen. The building is spacious and more like a chapel than a dining-hall. It is built of red-pressed brick, and its entire cost, although it is a large building, is only £1,300. The large door-way and the two large windows in front have semi-circular heads, with brick margins and keystones of granite. The hall is quadrangle, 115 feet long by 34 feet wide. The ceiling is 24 feet high, and light is admitted through skylights in the roof' and through the windows at each side of the hall. There are forty tables, giving accommodation to 400 persons. The seats are backed but not cushioned, and the tables are covered with mahogany oil-cloth. The walls are papered with a dark paper for a height of about five feet from the ground, and the remaining portion is covered with a lighter paper. There are a large mirror and a clock at one side of the room. The following is a copy of the bill-of-fare and prices:—Cup of coffee, 1d.; cup of tea, 1d.; cup of milk, ½d.; bread and butter, 1d.; bread and cheese, 1d.; slice of bread, ½d.; boiled egg, 1d.; slice of broiled bacon, 2d.; ginger beer, 1d—all of the best quality and always ready. Besides the above from twelve till half-past two, may be had—bowl of soup, 1d.; plate of potatoes, 1d.; plate of hot roast beef, 3d.; plate of hot boiled beef, 3d.; plate of hashed mutton, 2d.; plate of hashed beef, 2d.; plate of cold beef, 2d.; plate of cold ham, 2d.; plate of plum pudding, 1d. Dinner (between the above hours) of soup cold or hashed meat, potatoes, and pudding, 4½d. Breakfast (with the morning newspapers) ready at eight o'clock. The room is kept warm with stoves and gas, and is well ventilated. on the left-hand side there is a small room for women, with seats for between thirty and forty. This, it is expected, will be a very valuable part of the institution, whilst the whole establishment must be a great boon to the mechanical classes.—*London Sanitary Reporter*.

Catalysis.

Cold oxygen gas and carbonic oxide may lie in contact for years without combining together, but if a piece of clean platinum is placed in the mixture, the two gases immediately manifest an affection for each other, and enter into combination. The platinum itself undergoes no change, but induces the union of the other two substances by its simple presence. This is catalysis.

If starch is mixed with saliva and kept for a few minutes at a temperature of 100°, it is converted into sugar by a catalytic action of the saliva. It is stated by Dalton and other eminent physiologists that nearly all of the chemical changes which occur in the animal economy are due to this mysterious property.

Photographing Polished Silver.

The highly-polished surface of ornamental silver vessels is well known to occasion considerable trouble to the photographer, not only from the brilliant mass of light reflected, but from the number of irregular reflections from surrounding objects, the effect of which materially interferes with the due rendering of the design. Some very unsatisfactory results of this kind being obtained by a photographer for a large firm at the West End, the manager of the artistic department, an Irish gentleman of great resource, exclaimed to the photographer, "Why don't you put a piece of ice in the jug?" The question was solved in a moment. A piece of ice in the silver vessel would rapidly cool it, and so cause it to condense vapours on its surface from the surrounding atmosphere. This would just sufficiently dim the excessive luster to render a good photographic representation possible. Our readers should not forget the hint.—*Photographic News.*

Washing Photographs.

A wheel made on the same principle as a water-wheel, in which the *buckets* would contain the photographs to be washed, would revolve by the weight of the water in the buckets, the photographs being prevented from falling from these as the wheel revolved by several rods either projecting from the sides of the bucket or by a covering of metal net-work. As the wheel revolved the buckets would empty themselves, and thus the prints would by every revolution, be alternately floated and then drained.—*American Artizan.*

Durability of Granite.

The enduringness of the granite mountains belongs to the blocks cut out of them, down even to the smallest fragments. No material, accordingly, is so suitable for buildings or erections which are to be very lasting. The air can rust nothing out of granite blocks; rain can dissolve nothing out of them; rivers even may flow in granite beds for miles without ceasing to be soft—*i. e.*, unimpregnated with saline matter. Frost has little power to split them; their component particles are bound together by a strong cohesion; plants do not readily grow on them; they remain undiscolored for ages. In proof of this, we have the obelisks of the ancient Egyptians, still standing like detached peaks of granite hills.

The Home of the Muscovy Duck.

At a meeting of the Academy of Natural Sciences, Philadelphia, Mr. Hill stated that the habitat of the Muscovy duck is the Lake of Nicaragua. There travelers see them at all times, either in small breeding coteries, or large flocks. In the wild state their plumage is dark without any admixture of white. They were originally procured from the Mosquito shore, the country of the Muysca Indians (see Humboldt's researches), and hence is derived the name of Musco duck corrupted into Muscovy duck. The West Indian Islanders had early naturalized them, for on the discovery of Columbus, they speak of "ducks as large as geese," that they found among the Indians

The Electric Light.

The *Courrier de Bretagne* gives an interesting account of recent experiments with the electric lights at Lorient. The night was dark, many spectators assembled, in addition to the engineers and officers comprising a commission appointed specially by the maritime prefect. First the great dock, in which two ships were under repair, was rendered as light as day, so that the engineers were enabled to go down into it and examine all the details of the repairs. Next a signal mast fixed, at 700 yds. from the "Duchayla," and at 500 from the "Panama" steam frigates; the signals given by flags from the summit of the mast were rendered perfectly visible on board the two ships by means of the electric light. A third experiment caused great surprise and admiration. A diver descended 20 ft. under water, and by means of the light was enabled to distinguished the decimal divisions on a scale which was sent down to him and to give proofs of it. This experiment was deemed conclusive. It is now established that an electro-magnetic machine may be permanently fixed to light large workshops, submarine works, and narrow passages into harbours. It was further observed that when the light was brought to bear on the water shoals of fish were attracted by the unusual appearance, and continued to swim around the part lighted. Eels and other fish which were at the bottom of the sea came up to the surface.

Rule for Spellers.

Many otherwise accurate spellers are frequently puzzled in determining the relative position of *e* and *i* in words ending in eive.—Such will be greatly assisted by remembering the invariable rule that when the preceding consonant is a letter which comes after *i* in the alphabet, *e* comes after *i* in the word, as believe, replieve; but when the preceding consonant comes before *i* in the alphabet, *e* comes before *i* in the word, as receive.

A New Hydro-Carbon in the Coal-tar Series.

M. A. Bechamp recently announced to the French Academy of Sciences the discovery of a new hydro-carbon in the mixture that makes up coal tar. In rectifying with care the products which boil between 130° and 150° cent. (266° and 302° Fah.) M. Bechamp observed that the thermometer remained a long time stationary in the neighborhood of 140° (cent.), a temperature midway between the boiling points of xylole and cumole. Keeping this temperature constant, he separated from 30 measures of brown tar, one measure of a liquid hydro-carbon. A new rectification allowed the whole of this to pass between 139° and 140°. This constancy of the boiling point forbids the supposition that it is a mixture of xylole and cumole. By further purification with concentrated sulphuric acid and sodium the author finally succeeded in producing in the neighborhood of 900 cubic centimetres of a product boiling from the commencement to the end at a temperature between 139° and 140° (282° and 284° Fah.)—*Le Genie Industriel.*