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DISTRESS AMONGST THE OPERATIVES OF BRITAIN.

Recent accounts from Europe, and in particular from Great Britain, furnish abundant evidence of the fearful state of want and sore distress amongst the operative mechanics and labourers of the manufacturing districts of London and other localities. Reports of *Relief* Officers, Newspaper Correspondents, Clergymen and others, show that in many of the districts inhabited principally by operatives and labourers, from two fifths to five-sixths of the whole are out of employment, with no means of support but the public and private charities of their respective parishes. This deplorable state of things appears to have been brought upon them, in a great measure, by their own imprudent action, or that of the various trades' unions, in organizing *strikes* in the several branches of the iron and building trades, during the existence of extensive home and foreign contracts, which in consequence could not be completed. In the iron trades, especially, has this been the case; so much so, that it is said to have been the means of causing many orders to be sent to Belgium, instead of England, with the former of which these periodical strikes do not occur, and no fears are entertained of orders being unfulfilled at the time contracted for. The lower rate of wages paid in Belgium—said to be about one-half what are paid in England—also enables the Belgians to successfully compete with the English manufacturers.

The great want of the English operatives appears to be an efficient educational system (compulsory, if needs be, as with the factory act). The London *Engineer* says, "Education is amongst the social reforms we want. Much more than votes, do our operative classes require systematic elementary instruction." Were the operative classes better educated, they would not be controlled as they now are, to their own injury and the occasional distress and starvation of their families, by Committees of Trades' Unions, or other evil influences. The intelligent mechanic would be able to trace cause and effect, and to understand the consequences to himself and his country of having foreign contracts unfulfilled through the ever recurring conflict of labour *versus* capital, and to see that the interests of both are identical—that one cannot suffer without seriously affecting the other.

A proper appreciation of this principle is, as necessary, on the part of the capitalist and employers, as to the labourers; and until this is fully understood, complete harmony will not be restored between these *apparently* rival interests.

We are glad to learn from the speech of Her Majesty the Queen, at the opening of the present session of the Imperial Parliament, that a Royal Commission has been appointed to enquire fully into the working of the Trades' Unions in England. It is time that such an enquiry should be made—the operative classes have too long been the dupes of lazy demagogues and designing schemers, who in too many cases are leading lives of ease and comparative affluence, through the misplaced confidence of the less intelligent. The journal already referred to says, "When we look at the desolating systems of strikes, we cannot but regard Trades' Unions as standing evils scarcely mitigated by their action as relief clubs;" and when we consider that it is through the action of these unions that "work is leaving the country," and large numbers of mills are closed, we cannot but conclude that the writer's view of the evil is the correct one.

If then it is true that Trades' Unions and strikes are evils, and that labour does require to be protected in some measure against capital—a proposition we do not dispute—how is such a result to be attained, and so as to operate to the interests of both capitalists and lobourers?

At present we see but one way of satisfactorily solving this troublesome problem; and that is, on the co-operative plan now being adopted by some few large firms in Britain and elsewhere—the principle of which is well illustrated in the following extract from an article in the *Trade Review*, and copied on page 27 of the present volume of this Journal:—

"Mr. Fawcett, member for Brighton, lately made a speech at Leeds on the Co-operative Coal Company of Messrs. Briggs, in which he pointed out the great difficulties that surrounded the commercial position of England from the unsatisfactory relations existing between the classes of labourers and capitalists. He also pointed out what he believed to be the only certain way of palliating, if not remedying this evil, namely, by the growth of associations such as Messrs. Briggs' Coal Company, in which the interest of the capitalist and the labourer are to a certain extent identical, and in which the wages of the labourer, if too low, are supplemented by a share in the profits. The plan of the Coal Company is to pay, first, the regular rate of wages in the district, then 10 per cent. on all the capital of the company, and finally to divide the surplus between the capital and the labourer. This system, it will be perceived, is as nearly equitable as any arrangement can be. It gives to all those employed in the production, whether represented by capital, one of the great elements in production, or by labour, another of its chief elements, a similarity of interest, and a *pro rata* share in the profits. Mr. Briggs stated that the result had been not only to put a good bonus into the pocket of the labourers—a bonus of five per cent. on their wages—but to yield himself, as capitalist, a larger profit than he had ever before received, ever in the most prosperous years of the colliery's existence. This co-operation between capital and labour is only a variation of co-operative working societies, where the men themselves represent both the capital and the labour; but, as in the latter case, the efforts of the men are hampered by the smallness of their means at the commencement of their undertaking, we think the arrangement a better one where the capital is furnished, and the men, as in the case of the Coal Company above mentioned, given a certain share of the profits. They might also be allowed to invest their earnings in stock of the company, and thus give them a strong motive for the practice of economy and the virtues which are inseparable therefrom."

OUR SALMON FISHERIES.

During the past month a very interesting correspondence has been kept up in the columns of the *Globe*, on the past and present position of our Canadian Salmon Fisheries, and the artifical propagation of this fish.

A short time since a Mr. Wilmot, of Newcastle, C. W., exhibited in Toronto a vessel containing some 20,000 to 30,000 small salmon, about 12 days old and about 1 inch in length. These were the progeny of four female salmon, the ova of which was taken from a small stream in the township of Clarke, during last fall, and hatched by Mr. Wilmot in small wooden boxes, in his own house. These little fellows were very lively, and so transparent that the action of the heart and blood were distinctly visible. Mr. Wilmot has no doubt that, with his very limited experience, he can succeed in hatching about 80 per cent of the eggs produced; and when we consider how amazingly prolific the female salmon is, we can imagine the effect it would have on our inland fisheries, were the artificial culture of this fish more generally promoted. Unless the necessary protection is afforded the fisheries on the part of the Government and people of Canada, and their artificial progagation is encouraged, in a short time the salmon will scarcely be known in our waters. As one writer remarks, "they are driven away from their original spawning ground in the bays and rivers, by the advance of civilization in the shape of steamboats, schooners, sawmills, and in many cases by the seines and nets of fishermen, and in consequence are compelled to run on the open shores of the lake to spawn, exposed to the heavy storms of November and December, which wash up and destroy more than three-fourths of the spawns. There are plenty of little bays in the shore here which could be for a trifling amount converted into breeding places. A few hundred dollars would do the whole thing." There is no doubt that, a few years ago, our rivers and creeks abounded with this delicious fish. We have seen them regularly sold in the streets of Toronto, at prices not higher than is now asked for a good sized white-fish. One of the correspondents of the *Globe*, dating from the township of Clarke, and signing himself "*Salmo Canadensis*," says:—

"The writer is about a middle-aged man, yet he has seen as many as five hundred taken in one night, in a creek so small that an active man could jump over it at a single leap. He has with his own hands caught sixty in one day, and has at other times caught many hundreds in the same creek; older inhabitants will vouch for having seen over 1,000 salmon caught in one night in this little stream. This statement will apply to many of the creeks running into the lake from Kingston to Hamilton. Every small creek and stream had its salmon, and in the larger rivers, such as the Credit, Rouge, and Trent, they were still more numerous. Around my own neighbourhood are men now living who have caught one and two hundred salmon in a night.

In speaking of the salmon of Upper Canada, many persons from the Lower Provinces and elsewhere fancy they are the "salmon trout." I trust that they will disabuse their minds of this error, as the salmon taken in Upper Canada are the true *Salmo Salar*, as described by Cuvier, being identical with the Saguenay salmon in Lower Canada, and the St. John's salmon in New Brunswick, both of which I have seen. Should further proof be required, the living fish can be shown to the sceptic in November next in the creek referred to, by visiting "*Salmo Canadensis.*"

I shall now refer to another of the salmonidic tribe, the white-fish, reputed to be as delicate and finely-flavoured as any fish in the world, were known to abound in myriads along the shore of Lake Ontario. So plentiful were they and the catches so great, that thousands and tens of thousands were left upon the beach to rot and putrify. In years gone by it was usual for farmers and others to take two empty barrels to the fishing grounds; they would get one filled with white-fish, and leave the other as payment for the fish.

Our Lake also abounded in salmon-trout, herrings, and other fish. The rivers running into the Bay of Quinte—the Moira, Salmon, and Napanee—were at one time and at certain seasons almost overflowing with pickerel and suckers. The waters in the interior, Rice Lake, Scugog Lake, and others too numerous to mention, were all at one time teeming with maskinonge and bass, the former so plentiful that canoe loads could be caught in a single night; thousands could be caught by trolling, and in the winter sleigh-loads were frequently brought to the front for sale, having been caught through the ice.

The above may be considered by many as too glowing an account of the abundance of our fish in years past; the statements are however, quite within the mark, and I feel confident that there are hundreds of people who will corroborate every statement made.

Now let us contrast the past with the present. To see a salmon in any of our creeks now-a-days is considered quite a wonder, though there are two small creeks to my knowledge about eighteen miles equidistant from Port Hope, where some few salmon still come to deposit their ova, and which might yet be made the nucleus to propagate largely from. Our white-fish are almost exterminated; our salmon trout are becoming scarce; the maskinonge and bass are fast disappearing in our back lakes; in fact all of our valuable fish in this section of the Province are being rapidly destroyed, and will in a short time become extinct. Is not this indeed a sorry picture to look upon, so far as our fish and fisheries are concerned? Has not the time arrived when some effort should be made either by Government or the Fisheries Department to protect and reproduce in our waters these valuable fish, which but a few years ago were so plentiful? It certainly has, and no time should be lost by the proper authorities in endeavouring to carry out so desirable an object.

Do we not find in Great Britain that where rivers and waters had almost become barren of fish, that by proper culture they are now being replenished, and are becoming great sources of wealth. In France, we find an example worthy to be followed by every other country in the science of Pisciculture. She has so encouraged the artificial propagation of fish of all kinds, that her lakes, rivers, and streams, at one time almost depopulated, have now become replete with a cheap and wholesome food for her inhabitants. From the above facts, which are undeniable, why should we as Canadians remain longer dormant on so important a work. Agriculture receives aid and encouragement to produce wealth from our lands, why should not water culture receive similar aid in order to produce wealth from our waters."

Mr. F. W. G. Austin, of Quebec, in the same Journal, refers to the pleasing fact of Mr. Wilmot's success in hatching so large a per centage of young salmon, but asks:—

"In the present state of our fishery laws, how are these young fish to get to the sea, and back again as grilse? They are certain to be destroyed by the brush weirs on their way down to the salt water: and even should they escape these engines in their descent they run a double risk of being destroyed on their way back again, either from these wiers or from the stake nets planted on the shores of the St. Lawrence. These nets are of the most formidable kind, and are planted on both shores, from high to below low water mark, in the very course of the fish. It is these engines which have aided in destroying the salmon fisheries of the Province, and which nearly destroyed the same fisheries in England, Ireland, and Scotland, where they are now abolished by statute, and until our land is assimilated to that of England on this subject, the rearing of salmon or migratory fish is an utter impossibility, as any one holding a few acres of beech in the tidal portion of the shore of the St. Lawrence can stop, by the standing weirs and nets, all the fish produced in the rivers above him. This subject has given rise to more controversy than any other connected with the fisheries. Representations upon this very topic were made to the Commissioner of the Crown Lands while his last Fishery Act was held over for suggestions to improve the measure. I addressed him a pamphlet myself, pointing out the incongruity of affecting to develope the fisheries, and at the same time destroying the fish by the fixed nets, which prevented them from returning in sufficient numbers to their breeding grounds and native rivers. The language of British economists is emphatic on this head; Sir William Jardine asserts '*that these engines are opposed to the whole aim and spirit of the fishing laws.*' Sir Humphrey Davy gives his opinion in the following terms:— As all salmon and salmon-trout return to their native rivers, so 'stake net' fishing ought to abolished * * Salmon do not go far out into the sea, and always return along the coast, scenting out, as it were, their own river." Major King also alludes to the necessity of the complete removal from the shores of the St. Lawrence of all standing weirs and nets, as they hitherto, greatly impeded fish ascending and descending the river.—(page 260.)

The ova of salmon are only fecundated after leaving the parent fish, and this fecundation may be affected not only by the milt of the full grown male, but also by that of the grilse and the parr. About one half of the ova hatched become smelts and descend to the sea during the first year of their hatching, they remain in their nursery until the third year before they are ready to migrate. Salmon ova are never hatched in the sea, nor parr live in the salt water before assuming the smelt stage. All the smelts that have migrated to the sea, do not return the same year to their native river as grilse, one half return the next year as small salmon. It appears to be the law of these fish to descend to and return from the sea by double or divided migrations. The course of the salmon to and from the sea is always along the coast or shore where they find their food, and at the same time avoid more powerful enemies. — (Brown's Natural History of the Salmon.)

The report of the "Fish and Game Protection Club" for Lower Canada, recently submitted, shows the importance of the salmon fisheries, and the destructive nature of the "stake nets" and other obstructions. The report says:—

"The salmon fisheries protected by successive Commissioners of Crown Lands for the last nine years, yielded in 1865, with the use of 41,032 fathoms of fixed nets, salmon valued at $22,971.

The diminutive rivers of Britain, from which these engines were excluded a few years ago, produced at the close of last season a supply of the same fish, valued at $3,942,000.

Although these figures prove at a glance the practical nature of the views long advocated by this Club, your Committee wish to show the effect of Canadian stake nets upon the rivers of Canada, derived from the returns lodged at the close of each season with the Fisheries Department. The Moisie, the Natashquan, and the St. John, are the three principal salmon rivers on the north shore of the St. Lawrence. The first was leased by the Department in 1859, and yielded in 1862, 576 barrels of salmon; in 1863, 505½; in 1864, 530; in 1865, only 424, with 6,000 fathoms (more than six miles) of fixed nets. Decline, 151 barrels.

The Natashquan produced in 1862, 241 barrels; in 1863, 320; in 1864, 70; in 1865, 86, with 1970 fathoms of fixed nets. Decline, 153 barrels.

The St. John produced 1862, 256½ barrels; in 1863, 243; in 1864, 114; in 1865, 122, with 1715 fathoms of fixed nets. Decline, 134½ barrels.

It is thus incontestable that not only the annual produce of the best fisheries in the country is destroyed, but the capital stock also of these fisheries is broken in upon and diminished by these devouring engines. The Government lessees perhaps have a right to destroy the public fisheries, for "what fishermen fish for," remarks Bertram in the *Harvest of the Sea*, "is money; so long as their mode of fishing brings them money, it is all right. It is the same with all fisheries. * * * A man farming land would try to increase his capital by allowing his animals to breed—he would sow his crops in rotation; but the fish farmers destroy away without thinking of the next year's crop." * * * *

Canada possesses not only a sufficient number of rivers to provide sport for the whole continent, if the waters now barren, in which salmon once abounded were restocked, as it is manifest from what has been done in the United Kingdom within the last few years by the removal from the waters of fixed nets and other obstructions, but should furnish a revenue from the salmon fisheries alone, under proper management, sufficient to pay a great part of the interest on the debt of the Province when confederated.

This Club would respectfully direct the attention of the people of Upper Canada to the importance of recreating the salmon fisheries which formerly existed in that section of the Province, and which have been destroyed by abuses, which a little public spirit and determination would effectually remove.

We have given these very important extracts, embracing, in as brief a manner as possible, the opinions of those we consider to be amongst the most intelligent of our own Pisciculturists; and whose suggestions, if acted upon with vigor, would in all probability result in a re-stocking our streams with salmon—whether the migratory, or, as some of the correspondents referred to contends, "a genus of the true salmon, but natives of Lake Ontario only," it matters but little. On this, and some other interesting points, we shall again quote from one of the latest communications to the *Globe* by "*Salmo Canadensis*," he says:—

"To show that the salmon frequenting Lake Ontario, are the true *salar*, I shall endeavour to prove by comparison with the *salar* in other countries, and in other waters, which they frequent, and if it can be shown by any one that our salmon are a genus of the true salmon and natives of Ontario only, I shall be much pleased, because we shall then have within our reach, the greater source of wealth, as by the artificial process, which now appears to be practically introduced by Mr. Wilmot, we have only to place the fry of the Ontario salmon into the stream leading into Huron, Superior and other Lakes, and with care and protection, creating untold wealth to the Province. It is said as proof against having the 'salar' in Upper Canada, that they are never caught between Kingston and Montreal, that we get no 'giants' of their race, that our salmon are silvery in colour, rich and high in condition, which could not be the case with the 'Salar' when a long time in fresh water, and after travelling up the rapids of the St. Lawrence—all these objections, I think can be easily overcome. It will be necessary to state what naturalists say in reference to the salmon. 'That the most natural division of the salmon, having regard to characters, really important and conspicuous, and to the habits of the species, is the simple one, which is really nothing more than a formal recognition of groups *practically* recognized by every one acquainted with the fishes which compose them. 1, The silver or migratory species, those migrating to and from the sea—*Salmo Salar*. 2. The yellow or non-migratory species—*Salmo Trutta*. 3. The char or orange and red coloured species—*Salmo Umbla*.'"

Now, I believe that it is admitted by all, that the salmon frequenting the Tay. Tweed, Spey and Galway rivers in Britain; the Fraser, McKenzie and Columbia, on the Pacific coast; the Mingen, Moisie, Saguenay, Jacques Cartier and other tributaries of the St. Lawrence, are the pure *Salmo Salar*. Then why is it that a salmon frequenting the waters of Lake Ontario in like manner, and only a few hundreds of miles further up the St. Lawrence, with easy access to and from the sea, having the identical form, shape, colour, marks, habits and haunts, should not be the "silver or migatory salmon, *Salmo Salar?*" and if not, why should Ontario be the only exception to the universally acknowledged fact, that salmon frequent no waters in which they cannot have direct communication and easy access to and from the sea? As to salmon not being caught between Kingston and Montreal, I doubt very much, yet will admit the statement for the present, as it will not interfere with the fact of their migrature. Salmon make their appearance in Lake Ontario as early as May, and continue working their way slowly along the shore, and, in accordance with the unerring laws of nature and their instinct, seeking the river or creek in which they were formerly hatched themselves, in order that they may sooner or later deposit their ova for procreation during May, June and July, and even later; they are a beautiful silvery-coloured fish, rich and high in condition and delicious in flavour. By the month of October and November the ova will have become so far matured that they are compelled to enter the stream (the place of their own birth) to seek a suitable place to lay them, which is always in some swift, shallow, gravelly place. The female commences making a bed by throwing up the gravel, using her head and tail in doing so, making a sort of basin in the gravel, perhaps three or four feet wide, the length being somewhat more. Beds are sometimes much larger and sometimes much less in size. In this she deposits her ova. This process will take from three to ten days, according to circumstances. After entering the creek they apparently take no food, as I have tempted them with every possible description, but to no purpose. By this time they have become a black, lean, soft, flabby fish; parts of their fins, tail and body becoming actually raw from rubbing and working in the ground, in some instances covered with sores, parasitic insects attack and cling to them, yet strange to say the inhabitants residing near the streams actually kill them at this time, and in this state using them for food; the flesh being mere carrion. So soon as the process of spawning is over, and if any escape being caught, they immediately drop down the stream to the lake, thence down the St. Lawrence to the sea, in order to get rid of the parasites, and obtain food, which they there find in great abundance. This journey or migration from Lake Ontario to salt water, would take place in December, perhaps later, and would be easily performed in a few days, and at a season that, if myriads passed down the St. Lawrence, they would not be noticed. Although I have heard of these black lank salmon being seen between Kingston and Montreal late in the winter. When in the sea salmon put on flesh very rapidly, having been known to increase in weight from four and five pounds to ten and fifteen, in the space of three or four months. Smelt (young salmon), five or six inches long, and weighing only a few ounces, will leave their native stream go to the sea, and return again in a period ranging from two to four months, having increased in weight from two to five and six pounds, in some instances even more; these are well proven facts, having been thoroughly tested by experiments at the Doohulla and other fisheries in Ireland, and also in England and Scotland. Having described the period at which our salmon go down to the sea, and shown the time in which they can replenish themselves and gain their former good condition, and giving them three or four months in salt water, I will now notice their journey back. Salmon after replenishing themselves in the sea, commence their migration again to the fresh water in search of their native streams in order to carry out the periodical laws of their nature to reproduce their young. This migration from the sea, up the St. Lawrence, say between Montreal and Kingston, the place in dispute, would be perhaps March and April, being again at a time when large numbers might easily pass up unnoticed by any one, keeping the deep water, moving along rapidly, from the fact of there being no feeding grounds, or convenient places of resort, and reaching the foot of Lake Ontario about the latter end of April or beginning of May, where they are frequently caught both at the upper and lower gaps, and from this time till late in the fall they are taken, more or less, along the shore of Lake Ontario; and I have while writing been informed that they were formerly taken in large numbers near Cornwall. This then is the theory which I advance in reference to the migration of our salmon to and from the salt water, and I believe that it can be substantiated by the fact that it is very similar to the migratory habits of the salmon, both as to time and manner, in other waters which they frequent in other parts of the world. Now, as to having no "giants" of their race, the ordinary average weight of salmon taken in Britain and elsewhere, from what I can learn, will be about ten or twelve pounds, some are known to attain the weight of twenty, thirty, forty, and fifty pounds and even upwards; very large salmon, however, are not common. Our salmon in Lake Ontario in years past would average ten pounds easily when caught in the spring, and I have known them taken during the spawning season in our creeks, when in very low condition, weighing twenty, twenty-five, and thirty-two pounds, whilst I have heard of still larger fish being caught. Now, as to our salmon being silvery in colour and high in condition, which, it is asserted by "Ontarionensis," could not be the case after being so long in fresh water. Do not the "Salar" enter the rivers in Britain as early as May and remain there till late in the season, retaining their colour and condition? Are not the salmon of the lower St. Lawrence caught in the fresh water rivers during May, June, July, and later, having their bright colour and high condition? Then, why should not our Ontario salmon retain in a like manner the silvery appearance and high condition referred to? There are many other arguments and facts that I might produce as to the Ontario salmon being the "Salar," but space will not at present admit. There is one peculiarity, however, which I will mention, belonging only to the salmon, and is a proof of the identity of the fish everywhere, that is the cartilaginous excrescence or hook found upon the extremity of the lower jaw of the male salmon, or *kipper*, during the spawning season. I will now relate some facts in reference to the return of salmon to the same stream in which they were hatched, and in which salmon were never known till placed there through the artificial process. Mr. Ramsbotham, the celebrated pisculturist, in his operations in producing a new fishery at the Doohulla Lakes in Ireland, marked some seven hundred smelts by cutting off the adipois fin. In due time, the larger proportion of these marked smelts returned as grilse and salmon to the identical place, one in marking was found to be much larger than the others, and a different mark was put upon him. This same fish returned with the others having the peculiar mark, and still retaining his extra size over the rest. Experiments of a similar nature were made by marking young salmon produced by artificial means, in the Tay, and the Tweed, large numbers of the marked fish returning to the place of their birth as grilse, and salmon; it is also a remarkable fact that years ago, when salmon were plentiful in every creek in this neighbourhood, you could easily distinguish the fish caught in one stream from those in another; another evidence of each stream having its own family, in which they produce their young, and their young again when matured returning for a like purpose."

Since the above was in type, we see it stated that Mr. Wilmot has been appointed by the Inspector of Fisheries an Overseer of Fisheries on a portion of the north shores of Lake Ontario; and that a portion of the Fisheries' grant of money has been appointed to his system of artificial propagation.

TORONTO FIRE DEPARTMENT.

In the pages of this Journal we have frequently referred to the immense advantages of steam, over the old fashioned hand-power Fire-engine, both as to the more effectual protection of property, the great saving in expense of maintaining an efficient Fire-brigade in cities and towns, the absence of destruction of side-walks by running the engines thereon, as with the old machines, the reduction of premiums on Insurance Policies, and last, though not the least important, the breaking up of the old system of Volunteer Fire Companies, which, in their organization and management, are generally so destructive to the moral well-being of a large proportion of the young men of which they are composed.

The Chief Engineer of the city of Toronto Fire-brigade, Mr. Ashfield, has just submitted to the Council an important report, embracing the whole of the operations of this department for the past year. In estimating the efficiency of the Brigade, it must be borne in mind that Toronto contains about 50,000 inhabitants, scattered over a space, in round figures, some 3¾ miles long by 1¾ miles wide —or about 6¾ miles in all; and that the supply of water from the water works is only available for a small portion of the city, other portions being supplied by tanks, and a large portion for which there is no provision; and that as yet the system of Fire Alarm is very inefficient.

These disadvantages taken into account, we must conclude that the management of the department is entitled to great credit, for the efficiency and economy with which it is worked; and that it is, even in its present incompleteness, a model Institution, worthy the study and consideration of other City and Town Municipalities of the Province.

During the year there were fifty-five fires within the city limits, of which eighteen were extinguished without the aid of any of the Fire engines, two were extinguished by throwing three streams of water from the engines, eleven with two streams, and twenty-four with one stream only.

Loss and Insurance.

"The aggregate amount of insurance on buildings and their contents destroyed or damaged by fire during the year, as near as can be estimated are as follows:—

Total loss on buildings destroyed or damaged	$23,324
Total insurance on buildings destroyed or damaged	136,910
Total loss on contents of buildings destroyed or damaged	23,503
Total insurance on contents of buildings destroyed or damaged	51,400

The greater part of the foregoing statement of losses is made up from information kindly furnished by several of the insurance offices interested, and in most cases include the full amount claimed, notwithstanding that there are good ground for the belief that several parties claimed far more than the amount of their loss.

By reference to a record kept by the Chief Engineer, it will be seen that a large proportion of the losses were more than covered by insurance, that a few were barely covered, and on others there was no insurance.

The aggregate loss on buildings not covered by insurance was	$9,103
The aggregate of loss on contents not covered by insurance was	1,498

Number and Description of Buildings Destroyed or Damaged.

	Des.	Dam.
Brick dwellings or stores		18
Brick workshops, stables or outhouses		2
Frame dwellings or stores	25	26
Frame workshops, stables or outhouses	20	11
	45	57

Cause of Fire so far as known.

Not known		19
Incendiary		15
Rekindling of old ruins		1
Accidental from chimneys on fire	4	
" defective stove pipes	2	
" defective chimneys	1	
" defective zinc under stove	1	
" carelessness about foundries	2	
" children playing with matches	2	
" tobacco smoking	1	
" varnish boiling over	1	
" sweet nitre boiling over	1	
" matches among clothes	1	
" sparks from brass furnace	1	
" overheating of heating furnace	1	20
		55

During the year there were 25 false alarms, principally caused by chimneys on fire.

Water Supply.

"The supply of water to extinguish fires during the year 1866, at which one or more of the engines were used, was obtained as follows:—

From hydrants for	24 fires.
" the city tanks	8 "
" the bay	1 "
" the bay and a hydrant	1 "
" one of the city tanks and a hydrant	1 "
" private wells	1 "
" private cistern	1 "
	37

The total quantity of water used from hydrants for extinguishing fires during the year 1866, does not exceed 400,000 gallons.

Water Tanks.

The double tanks referred to by the Engineer, are two single tanks placed close together, and connected near their base by a pipe.

The Report says:—

"In June, 1862, the City Council made an appropriation of $2,000 to build tanks in parts of the city where no other means of supply of water could be got. In the latter part of that year five tanks were built, and in 1864 five others. There are now about ten double tanks, each double tank will contain about 13,000 gallons. These tanks have been often used for extinguishing fire, and in every instance afforded a sufficient supply for the time and purposes required. The engines work much more satisfactorily from tanks than from hydrants."

The following lengthy extracts are so important, as suggestive to municipalities proposing to organise steam-engine brigades, that we give them in full:—

Steam Fire Engines.

"In the year 1861, steam fire engines were first introduced in this city, and early in the following year a By-law was passed by the City Council for the organization of a fire department with steam engines, the working expenses of which—not including the salary of the Chief Engineer—was not to exceed $8,000. In the same year, 1862, the use of hand engines for extinguishing fire in this city was entirely discontinued. Since then the working expenses of the department has been kept within the annual appropriation. From the time the hand engines were discontinued in 1862, up to July, 1866, the whole power used for extinguishing fire in the city was two steam engines. As these, however, like other machinery, are liable to failure, an appropriation was made by the City Council of 1866, and in July last a third steam engine was purchased. When purchasing the third engine it was not intended to run the three, for, besides the extra expense that that would incur, it is a well known fact that in the majority of cases of fires a sufficient supply of water cannot be obtained (within any reasonable distance) for two engines. One of the three engines is now kept in reserve to meet the contingency of a failure of either of the other two (in ordinary use), or should an emergency unhappily arise, the reserve engine to be brought out and put to work, if sufficient hose and a supply of water within working distance can be obtained.

New Rubber Hose.

In addition to the appropriation made last year for the purchase of a new steam engine, the City Council made provision for the purchase of 1,000 feet of rubber hose, for which an order was given to Messrs. R. Lewis & Son of this city, agents for the Canadian Rubber Company in Montreal. The hose has been in use by the fire department in this city for several months, and appears to be a well made, serviceable article.

Apparatus of the Fire Department.

Three first class steam fire engines.

Two large hose carts and one small one.

One hook and ladder truck, with ladders, hooks and axes.

One fuel waggon.

One thousand feet of good rubber hose.

One thousand four hundred feet of middling rubber hose that has been in the service more than five years.

The steam engines are all from the manufactory of Mr. H. C. Silsby, Seneca Falls, N. Y.

Each engine has two branch pipes with various sized nozzles, twenty feet of rubber suction hose, with copper strainer and hydrant coupling, a fuel pan and several other necessary articles. The No. 2 engine, stationed at Court Street fire hall, is furnished with one of "Oyston's adjustable stream spreading nozzles," presented to the chief engineer for the use of the fire department by the "British America and some two or three other Insurance Companies. Each engine can from a good supply of water do good work in extinguishing fires, throwing, at the same time, a stream through two lines of hose, each 1,000 feet in length, or through one line any length under one-third of a mile. These engines all ready to go to a fire, with water in the boiler, and sufficient fuel for one hours work will weigh from 6,500 to 7,000 lbs., and unless when the roads are almost impassible for wheeled vehicles, is hauled to and from fires by two horses.

On the 1st of Oct. last, the No. 1 engine was placed as the reserve engine and the No. 3 (the last purchased), placed in position for service, and has since then proved to be in no way inferior to the other two.

Engine Stations &c. in use by the Fire Department.

At the Bay street Fire Hall:
- One steam engine in service,
- do. do. reserve,
- One large hose cart and one small one,
- One fuel waggon,
- 1,600 feet of rubber hose.
- Two horses to haul engine,
- One horse to haul the hose cart.

At the Court street fire hall:
- One steam fire engine in service,
- One large hose cart,
- One hook and ladder truck, with ladders, hooks, and axes,
- 800 feet of rubber hose,
- Two horses to haul the engine,
- One horse to haul the hose cart,
- One horse to haul the hook and ladder truck.

Fire Apparatus not in use by the Fire Department, now lying at the Fire Halls.

Four good hand fire-engines, and two old gooseneck engines,

Three hose reels and about 3,000 feet of leather hose.

Two of the engines were very little used before the steam engines were brought to the city. They are now nearly as good as new, and may be ranked among the best made in the Province. These engines have been offered to parties wanting engines at half their value, but such is the prejudice of fire companies and others to buying a second-hand engine, helped by parties anxious to effect a sale of their own, that higher prices have been paid for inferior engines, for no other reason apparently than their being new.

These engines and a large portion of the hose would do good service in any town or village where steam engines are not in use.

Fire Department.

The Fire Department consists of one Chief Engineer and one Assistant Engineer, two Engineers and two Firemen of Steam engines, one caretaker of apparatus and one fire company of thirty four men, including one bugler.

The fire company is told off into three sections of ten men and a foreman to each section. Nos. 1 and 2 are branch and hose men, and No. 3 are hook and ladder men.

To each section are appointed three supernumeraries, who receive no remuneration for their services, unless some member or members of the section to which they are appointed shall be returned as absent at a fire at which the supernumerary shall be returned as present doing duty.

For the purpose of hauling the engines and other apparatus to and from fires, &c., seven horses and five drivers are engaged under contract, which contract can be terminated by either party giving one month's notice.

The efficiency of the department—notwithstanding the very defective means of fire alarm and the want of a supply of water on some occasions of fire—has been repeatedly acknowledged in highly complimentary terms, by gentlemen deeply interested in the welfare and protection of the city from fire. With regard to its expenses, it may be safely said that in no other city on this Continent, of equal size and extent, where steam fire engines are in use, is the Fire Department on so economical a scale as in the City of Toronto.

Fire Alarm.

"The bells in use for the purpose of giving alarm on occasions of fire in this city are not so effective as formerly, when the city could not boast of as many extensive blocks of high buildings as at present. There is no look-out or watch kept at any of the engine or fire-alarm stations, and it often happens that fires do occur for which some of the principal bells are not rung at all. Along with all this, there are many parts of the city in which, should a fire break out, a messenger to convey the intelligence to the nearest engine or alarm station, may have to travel nearly two miles. and, before reaching—saying nothing of the shortest time possible to get the engines and other apparatus to the place of fire—the building where the fire originated with all its contents, together with other property adjacent thereto, may be entirely destroyed. The great advantage afforded where information of the breaking out of fire is speedily and correctly communicated to the engine stations, cannot be over-estimated. The most effective system for that purpose, and no doubt the most economical when all its advantages are taken into account, is the Fire Alarm Telegraph. By this system any number of signal stations (few or many) may be scattered over a city, from any one of which an alarm may be communicated instantaneously. The number of the station from which the alarm proceeded is telegraphed to the Fire Department, so that the engines may be headed from the start to the exact locality of the fire. By this means one or two engines and a limited supply of water, is more effectual in preventing large conflagrations, than twice the number of engines and an unlimited supply of water would be without it."

The report concludes by recommending a number of improvements, tending to the comfort and greater efficiency of the Brigade.

JOURNALS WANTED.

If any of our readers have January or December numbers of this Journal, for the year 1862, which they are not intending to file; or March, August, September or November numbers for 1863, we would feel obliged if they would forward them to us, for which we will allow their full value; or for full volumes of either or both the years 1862 and 1863, we will pay cash, or allow their value in subscriptions to the Journal for the current or any other years. We require these numbers to complete sets.

Board of Arts and Manufactures

FOR UPPER CANADA.

BUREAU OF AGRICULTURE AND STATISTICS PATENT OFFICE.

OTTAWA. 25th JANUARY, 1867.

(Continued from page 295, vol., VI.)

His Excellency the Governor General has been pleased to grant Letters Patent of Inventions for a period of fourteen years, from the dates thereof, to the persons whose names are included in the following list.

Published by command,
A J CAMBIE.
Acting Deputy to the Minister of Agriculture.

ELIJAH BURTON SHERBURNE, of the Township of East Williams, in the County of Middlesex, Apiarist, "A Flax-extending Drove Exterminating Miller and Robber-Proof Bee-Hive."—(Dated Ottawa, 3rd July, 1866)

ALEXANDER KIRKWOOD, of the City of Ottawa, in the County of Carleton, Gentleman. "A new and useful kind of paper called 'Meliotus Paper."—(Dated, Ottawa, 8th August, 1866.)

HENRY CARTER, of the Township of Malahide, in the County of Elgin, Blacksmith, "A new and useful Machine. called Carter's combined Ditching and Sod and Turf Cutter."—(Dated Ottawa, 18th August, 1866.)

JOHN LAMB. of the City of Ottawa, in the County of Carleton, Mill-Wright, "A new and useful water-Wheel."—(Dated Ottawa, 23rd August, 1866.)

LEWIS VAN CAMP, of the Town of Berlin, in the County of Waterloo, Dentist, "A certain new and useful improvements in instruments for the application of Fluids, for the production of topical anæsthesia, called 'Van Camp's Patent spray-tube.'"—(Dated Ottawa, 23rd August, 1866.)

JOHN WATSON, of the Town of Guelph, in the County of Wellington, Mill-Wright, "A certain new and useful improvemeet in the Turbine Water-Wheel."—(Dated Ottawa, 23rd August, 1866.)

CALVIN ATHERTON, of the village of Union, Township of Yarmouth, County of Elgin, Carriage-Maker, "Atherton's Union Carriage Springs."—(Dated Ottawa, 31st August, 1866)

WILLIAM HENRY RODDEN, of the City of Toronto, in the County of York, Commercial Traveller, "A New and improved system of piping for water cisterns,"—(Dated Ottawa, 31st August, 1866.)

JOSEPH JAMES INGLIS and DAVID SPENCE, Assignees of Thomas Wilkinson, Gentleman, "A Composition of matter for illuminating or other purposes."—(Dated Ottawa, 31st August, 1866.)

JOHN BURKE, of the Town of Belleville, in the County of Hastings, Gentleman, "An improvement in Breech-loading Fire Arms."—(Dated Ottawa, 11th September, 1866.)

MARTIN COLLET, of the City of Toronto, in the County of York, Meat Packer, "Collet's method of slaughtering and preserving meat."—(Dated Ottawa, 11th September, 1866.)

CHARLES INGERSOLL CORBIN, of the Township of East-Oxford, in the County of Oxford, Rake-maker, "A Certain new and useful improvement on the Revolving Horse-Rake, the so improved Rake to be called "Corbin's improved Revolving Horse-Rake."—(Dated Ottawa, 13th September, 1866.)

ELIHU SPENCER, of the City of Ottawa, in the County of Carleton, Photographer, "A Certain new and useful improvement in the the manner of inserting India Rubber Elastic into leather Boots and Shoes."—(Dated Ottawa, 13th September, 1856.)

JOSEPH FREDERICK RAINER, of the Town of Whitby, in the County of Ontario, Piano-maker, "A New and useful style of Piano, known, as Rainer's new Elliptic Piano."—(Dated Ottawa, 13th September, 1866.)

PARLEY JABEZ AYRES, of the Town of Peterborough, in the County of Peterboro', Machinist, "A new and useful Auger-Handle, called "Ayres magic Augur-Handle."—(Dated Ottawa, 13th September, 1866.)

LEON MOSES CLENCH, of the Town of St. Mary's, in the County of Perth, Barrister, "An elbow-needle bar, silent motion and oscillating feed attachment for sewing machines, to be called "Clench's Elbow Needle-bar, silent motion and oscillating Feed attachment for Sewing Machines."—(Dated Ottawa, 13th September, 1866.)

PARLEY JABEZ AYRES, of the Town of Peterborough, in the County of Peterboro', Machinist, "A new and useful Tire upsetting machine, called "Ayres Improved Tire upsetting machine."—(Dated Ottawa, 13th September, 1866.)

ROBERT HILL, of the Village of Nobleton, in the County of York, Machinist, "Certain improvements in the side gearing for Threshing Machines," in addition to those for which he has already obtained Letters Patent of Invention in Canada, bearing date the 2nd day of August, A.D., 1865—(Dated Ottawa, 13th September, 1866.)

HUGH BAINES, of the City of Toronto, in the County of York, Gentleman, "A New and useful steel-cased axle and shaft with steel bushed wheels and bearing for all kinds of Rolling Stock and Machinery."—(Dated Ottawa, 13th September, 1866.)

THOMAS HENDRY, of the Township of Whitchurch, in the County of York, Blacksmith, "An improved Plough, certain improvements in which are new and useful."—(Dated Ottawa, 13th September. 1866.)

JOHN ALEXANDER KENNEDY, of the Township of Blenheim, in the County of Oxford, Carpenter, "A New and useful improved Waggon Jack."—(Dated Ottawa, 17th September, 1866.)

OTTO ROTTON, of the City of Kingston, in the County Frontenac, Doctor of Medicine, "A new useful and improved still, called "The Double Exhaust Conical Still or Evaporator."—(Dated Ottawa, 17th September, 1866.)

OTTO ROTTON, of the City of Kingston, in the County of Frontenac, Doctor of Medicine, "A new useful and improved still called 'The Acephaloid Still.'"—(Dated Ottawa, 17th September, 1866.)

OTTO ROTTON, of the City of Kington, in the County of Frontenac, Doctor of Medicine, "A new and useful method of applying cement within the closed barrels, of other vessels called 'The Direct Force Cementing Process.'"—(Dated Ottawa, 17th September, 1866.)

DANIEL MCDOWELL, of the City of Montreal Mechanical Engineer, "A new and useful apparatus for cleaning flues of Steam Boilers."—(Dated Ottawa, 18th September, 1866.)

ALEXANDER BUNTIN, of the City of Montreal, Paper Manufacturer, for the introduction of "A new, and useful invention known as Hemrich Valter's Machine for Pulping Wood for the Manufacture of Paper."—(Dated Ottawa, 19th September, 1866.)

WILLIAM MCEVILLA, of the Village of Roxton Falls' in the County of Shefford, Watchmaker and Jeweller' "A Pocket Watch Safe."—(Dated Ottawa, 19th September, 1866.)

HORACE SAWYER, of the Township of Eaton in the County of Compton, Trader, "A new and useful improvement in the manufacture of the Extract of Tan Bark, and other material."—(Dated Ottawa, 19th September, 1866.)

OLIVER CAMPBELL, of the Township of Compton, in the County of Compton, Miller, "A new and useful Water Wheel and Curb."—(Dated Ottawa, 19th September, 1866.)

HENRY WALKER, of the Village of Buckingham, in the County of Ottawa, Miller, "A Vice Mill Stone Pick."—(Dated Ottawa, 19th September, 1866.)

EDWARD B. MEYER, of the City of Quebec, Gentleman, "New and useful improvements in Drilling Machines."—(Dated Ottawa, 19th September, 1866.)

THOMAS MARA FELL and AMBROSE GEORGE FELL, of the City of Montreal, Chemists, "Certain new and useful improvements in the Manufacture of White Lead."—(Dated Ottawa, 19th September, 1866.)

ALEXANDER BUNTIN, of the City of Montreal, Paper Manufacturer, for the introduction of "A new and improved Machinery for Pulping Wood for the Manufacture of Paper."—(Dated Ottawa, 20th September, 1866.)

AARON MAGOON, of the Township of Stanstead, in the County of Stanstead, Farmer, "A new and improved Rotary Harrow."—(Dated Ottawa, 25th September, 1866.)

GEORGE SCOTT, of the City of Montreal, Pattern Maker, "A new and improved Bedstead Fastener."—(Dated Ottawa, 25th September, 1866.)

CHARLES LAMAIN, of the Township of Hamilton, in the County of Northumberland, Yeoman, "A new and useful Cultivator."—(Dated Ottawa, 29th September, 1866.)

ROBERT BARCLAY, of the Town of Paris, in the County of Brant, Watchmaker, "A certain new and useful improvement in Sewing Machines."—(Dated Ottawa, 29th September, 1866.)

ALEXANDER GALE ALEXANDER, of the City of Hamilton, in the County of Wentworth, Plumber and Gas Fitter, "A new and useful means and apparatus for generating hydrocarbon Vapors and continuing an uniform flow thereof."—(Dated Ottawa, 29th September, 1866.)

JOHN JONES, of the City of Kingston, in the County of Frontenac, Coach Builder, "A Horse-Hay Fork."—(Dated Ottawa, 29th September, 1866.)

WILLIAM EASTWOOD TENCH, of the Town of Clifton, in the County of Welland, Gentleman, "A new and useful Pump apparatus for superseding Bags in Artesian Wells."—(Dated Ottawa, 29th September, 1866.)

CORIDON LEWIS, of the Village of Salford, in the Township of Dereham, in the County of Oxford, Cooper, "A New and useful Dairy-man's Churn."—(Dated Ottawa, 29th September, 1866)

CHARLES LYONS, of the Town of Simcoe, in the County of Norfolk, Gentleman, "A Steel Headed Railway Rail, also a method by which steel can be welded on or in the head of a railway rail so that it cannot be loosened and rendered useless until the head is actually worn down."—(Dated Ottawa, 29th September, 1866.)

ROBERT LOUDON, of the Village of Bothwell, in the Township of Zone, in the county of Kent, Machinist, "A certain new and useful improvement in the construction of Steam Boilers and Engines, to control the draught and dispense with the Blast-pipe, in combination with the new invention by one J. G. Shirts, for the use of Petroleum as fuel."—(Dated Ottawa, 3rd October, 1866.)

FELICITÉ MARAIS, of the City of Montreal, "A composition of matter to be called "English Cleansing Fluid of F. Marais."—(Dated Ottawa, 4th October, 1866.)

HENRY YEAGER, of the City of Hamilton, in the County of Wentworth, Wheel-wright, "A new and useful Machine for Pitching and Loading Hay and Straw called, 'Yeager's Revolving Hay Pitcher.'"—(Dated Ottawa, 4th October, 1866.)

WILLIAM GILL, Engineer, of the City of Toronto in County of York, and JAMES DUFF, of the same place, Boiler Maker, "A New and useful machine for the safer and better management of Steam Boilers."—(Dated Ottawa, 5th October, 1866.)

CHARLES FREDRICK BRUTON, of the Town of Napanee, in the County of Lennox and Addington, "An Improved Flannel cloth and yarn mixture."—(Dated Ottawa 9th October, 1866.)

JOHN ISREAL ENSLEY, of the City of London, in the County of Middlesex, Machinist, "A new and useful method of fastening Hoops."—(Dated Ottawa, 12th October, 1866.)

JOHN HENRY EAKINS, of the Township of Enniskillen, in the County of Lambton, Oil Producer, "A new and useful improvement in the valves used in pumping Oil-wells."—(Dated Ottawa, 12th October, 1866.)

JAMES WILSON, of the Township of Nelson, in the County of Halton, Lumber Merchant, of "A new and useful improvement on the Steam Engine, known as 'The Central Application Non-Friction Valve.'"—(Dated Ottawa, 13th October, 1866.)

LEONARD HOFFMAN BOOLE, of the City of Ottawa, in the County of Carleton, Architect, "A new and useful manner of Preserving Eggs in a granulated or compact form to be known as 'Booles Granulated Eggs.'"—(Dated Ottawa, 18th October, 1866.)

THOMAS WELLIS, of the Township of Blanshard, in the County of Perth, Yeoman, "A new and useful Improved Horse Rake."—(Dated Ottawa, 18th October, 1866.)

ALEXANDER GALE ALEXANDER, of the City of Hamilton, in the County of Wentworth, Plumber and Gas Fitter, "A new and useful method of Generating or Increasing the power of Hydro-carbon Gas."—(Dated Ottawa, 18th October, 1866.)

ROBERT ROGERS, of the City of Montreal, Merchant Tailor, "A new and useful Gas Stove Furnace and Range."—(Dated Ottawa, 25th October, 1866.)

REVD. JOHN DURRANT, of the Town of Stratford, in the County of Perth, Congregational Minister, "A new and useful flexible cleaner for Lamp Chimnies and glass Globes."—(Dated Ottawa, 30th October, 1866.)

GEORGE JAMES BAKER, of the Town of Oakville, in the County of Halton, Livery Stable Keeper, "A new and useful method of fastening buckles in harness, bridles, reins, martingales, and stirrup leathers, and for the fastening of all other straps, used about harness."—(Dated Ottawa, 30th October, 1866.)

BENJAMIN BOWMAN BEMIS, the younger, of the Village of Winterbourne, in the County of Waterloo, Dentist, "A new and useful machine for the drying of grain called 'Bemis's Canadian Grain Dryer.'"—(Dated Ottawa, 30th October, 1866.)

MOTT BILLINGS BROOKS, of the Town of Brockville, in the County of Leeds, Tinsmith, "A new and useful machine which he has named 'Brook's Patent Ribbon Roller and self measuring machine.'"—(Dated Ottawa, 30th October, 1866.)

JOHN HOULGRAVE, of the Town of St. Catharines, in the County of Lincoln, Gentleman, "A new and useful spring bed bottom."—(Dated Ottawa, 30th October, 1866.)

CHARLES CLARK CLUTE, of the Town of Picton, in the County of Prince Edward, Telegraphist, "A New and useful apparatus for purifying and enriching common illuminating Gas."—(Dated Ottawa, 31st October, 1866.)

JAMES WILLIAM DAVIS, of the Town Galt, in the County of Waterloo, Tinsmith, "A Mould Board called "The Maple Leaf.'"—(Dated Ottawa, 7th November, 1866.

THOMAS DAVIS, of the Village of Portsmouth, in the County of Frontenac, Mariner, "A new and useful Friction Wedge, Power."—(Dated Ottawa, 9th November, 1866.)

JOSEPH S. WALTON, of the Town of Sherbrooke, Printer, Assignee of Richard Smith, of the same place, Machinist, "A new and useful machine called 'Smith's Egg Beater.'"—(Dated Ottawa, 12th November, 1866.)

MATHEW T. WYATT, of the City of Quebec, Machinist, "A new and useful Butting Machine."—(Dated Ottawa, 21st November, 1866.)

MATHEW T. WYATT, of the City of Quebec, Machinist "A new and useful Combined Butting, Splitting, and Lath-making Saw Bench."—(Dated Ottawa, 13th November, 1866.)

THOMAS DAVIDSON, of the City of Montreal, Manufacturer. "An Improved bottom or Top of Sheet, Metal Vessels."—(Dated Ottawa, 13th Novembert 1866.)

SAMUEL RUSSEL WARREN, of the City of Montreal, Organ Manufacturer, "An Improved Miniature Organ."—(Dated Ottawa, 13th November, 1866.

WILLIAM HAMILTON, of the City of Toronto, in the County of York, Iron Founder "A new and useful inprovement in the Fastening of Nuts on Railway and other Bolts."—(Dated Ottawa, 13th November, 1866.)

HENRY C. PRITCHARD, in the City of Toronto, in the County of York, Machinist, and SAMUEL LATHAM, of the same City, Gentleman, "A new and useful Shoe Trimmer."—(Dated Ottawa, 15th November, 1866.)

ARCHIBALD MCDONALD FORSTER, of the City of Hamilton, in the County of Wentworth, Mechanical Engineer, "A new and useful Anti-incrustation Powder for Boilers."—(Dated Ottawa, 15th November, 1866.)

ROBERT PATTERSON JELLET, of the Town of Belleville' in the County of Hastings, Barrister-at-Law, "A new and useful Telescopic Jointed Gun."—(Dated Ottawa, 15th November, 1866.)

WILLIAM THOMPSON, of the City of Toronto, in the County of York, Machinist, "An improved apparatus for Carbonating Illuminating Gases."—(Dated Ottawa, 19th November, 1866.)

JOHN PRICE OLIVER, of the Village of Kingsville in the County of Essex, Blacksmith, and WILLIAM MALLOTT DRAKE, of the same place, Mariner, "A new and useful Quilting Frame."—(Dated Ottawa, 21st November, 1866.)

JAMES JOHNSON HALL, of the Town of St. Mary's, in the County of Perth, Doctor of Medicine, "A new Illuminating Oil, to be known as 'Hall's Illuminating Oil.'"—(Dated Ottawa, 22nd November, 1866.)

JOHN MCBETH, of the Village of Corunna, in the Township of Moore, in the County of Lambton, Gentleman, "A new and useful pavement called 'The Improved McBeth Pavement.'"—(Dated Ottawa, 22nd November, 1866.)

JAMES JOHNSON HALL, of the Town of St. Mary's, in the County of Perth, Doctor of Medicine, "A new and useful Spirit Gas."—(Dated Ottawa, 22nd November, 1866.)

ROBERT HOPKINS, of the Township of East Williams, in the County of Middlesex, Tinsmith, "A Lamp known as 'The Victoria Oil Lamp.'"—(Dated Ottawa, 23rd November, 1866.)

JOSEPH CLINTON HENDERSON, of the Town of Brockville, in the County of Leeds, Iron Founder, "A new and useful Joint for the Rails of Railways, called 'Henderson's Patent Rail Joint.'"—(Dated Ottawa, 24th November, 1866.)

PETER HENRY FERL, of the Town of Windsor, in the County of Essex, Machinst, "A new and useful verticle deep water fishing Machine, called 'Peter H. Ferle's vertical deep water Fishing Machine.'"—(Dated Ottawa, 24th November, 1866.)

WILLIAM LEMON, of the Village of Lynden, in the County of Wentworth, Gun-smith, "A new and useful method of altering the Enfield Rifle, or any other muzzle-loading Rifle into a Breech-loader, to be known as Lemon's Breech-loading Rifle."—(Dated Ottawa, 27th November, 1866.)

FREDRICK OAKLEY, of the City of Toronto in the County of York, Carpenter, "A new and useful Egg and Cream Beater, called 'Oakley's Egg and Cream Beater.'"—(Dated Ottawa, 27th November, 1866.)

THOMAS M. OTTLEY, of the Village of Fort Erie, in the County of Welland, Yeoman, "A new and improved Feed Cutter."—(Dated Ottawa, 27th November, 1866.)

THOS. COXON COLLINS, of the City of Toronto, in the County of York, Brass Founder, Assignee of the Fred. Oakley, of the same place, Carpenter, "A new and improved Burglar-alarm and Door-Fastener combined."—(Dated Ottawa, 28th November, 1866.)

JOHN WATSON, of the Town of Guelph, in the County of Waterloo, Millwright, "A certain new and useful improved Brick Machine, for making or pressing bricks of clay or other suitable materials."—(Dated Ottawa, 28th November, 1866.)

H. ALEX. SCHOMBERG, of the City Toronto, in the County of York, ———, "Certain new and useful improvement in a Combined Mop and Scrubber, made by one Alma Clematus Bacon."—(Dated Ottawa, 1st December, 1866.)

RICHARD SMITH, of the Town of Sherbrooke, in the District of St. Francis, Machinist, "A new and useful improvement in Machines for the Manufacture of Paper, to be called 'Smith's Steam Regulator for Paper Machines."—(Dated Ottawa, 3rd December, 1866.)

WM. JAMES SHEE HOLWELL, of the City of Quebec, Provincial Land Surveyor, "A new and useful elastic Roller Sash spring for sliding windows in Railway cars, Houses, &c, with self-adjusting and screw adjusting appliance for regulating pressure of Roller."—(Dated Ottawa, 4th December, 1866.)

LEONARD HOFFMAN BOOLE, of the City of Ottawa, in the County of Carleton, Architect, "A new and useful combination of machinery to be hereafter known as 'Boole's Drying Machine.'"—(Dated Ottawa, 4th December, 1866.)

EDWARD ROWE, of the Village of Lyn, in the Township of Elizabethtown, in the County of Leeds, Gentleman, "A new and useful Pump Gearing."—(Dated Ottawa, 10th December, 1866.)

WILLIAM JAMIESON, of the Township of Lochiel, in the County of Glengary, Yeoman, "A new and useful Machine for lifting and removing Stones."—(Dated Ottawa, 11th December, 1866.)

SIMON PETER GRAHAM, of the Village of Springford, in the County of Oxford, Blacksmith, "An Iron Buggy Body."—(Dated Ottawa, 11th December, 1866.)

MISS MARY HERCUS CHRISTIE, of the City of Toronto, in the County of York, Spinster, "A new and useful Hinged Pan and Sifter combined, to be called and known as 'The Toronto Sifter.'"—(Dated Ottawa, 17th December, 1866.

ROBERT HUNT, of the Village of Plattsville, in the County of Oxford, Gentleman, "A new, useful and improved Reverse Twisting and Double Action Apparatus for Spinning Machines, called 'Hunt's Reverse Twist Spinning Gears.'"—(Dated Ottawa, 19th December, 1866.

HUGHBERT JAMES SUTTON, of the City of London, Builder, "A new and useful Solidified Oil or Lubricating Grease."—(Dated Ottawa, 20th December, 1866.)

THE latest style of collar for men has turned-down corners, on which appear dogs and horses' heads. Asses' ears are worn a little *higher up*.

SIR ISAAC NEWTON is said to have worn in his finger ring a loadstone weighing three grains, and capable of sustaining over two hundred and fifty times its own weight.

The longest tunnel in England is the box tunnel on the Great Western Railway, which is 9,680 feet long, 39 feet high, and 35 feet wide.

Full growth of potatoes is necessary to full development of starch.

Selected Articles.

ON OZONE AND ITS RELATIONS TO ANIMAL CHARCOAL.

BY T. W. TOBIN.

There are three forces necessarily called into action in a simple chemical combination of two elementary bodies, and the formation of the resulting compound—first, a force by which each of the primary substances undergoes a decomposition or destruction of its constitution; secondly, an attractive force, a mutual affinity between the respective elements; and thirdly, a new force is created, effecting the structure of the resulting compound. The absence of, or interference with, either of the two former conditions prevents or modifies the reaction, and the chief governing principle in most instances of combinations is the inertia offered by one or both of the primary bodies to the decomposition of form. The presence of a third neutral body sometimes greatly modifies the behaviour of the two active elements, although not in itself suffering any change of constitution—a property remarkable in itself as proving exceptionable to the doctrine of chemical affinity. The action, moreover, is inexhaustible and continuous, it is in proportion with the quantity of the substance.

This peculiar action has been named "*catalysis,*" but to accurately define the extent of the term would be proceeding on doubtful ground Numerous instances abound in which the direct cause may be traced to this principle, in others it offers the best explanation as to the reactions of substances on each other. The behaviour of finely divided platinum, known as "spongy platinum," on a mixture of hydrogen gas and atmospheric air or oxygen gas is an instance in question. In the voltaic action of an acid on an oxidizable metal influenced by the presence and contact of another less oxidizable metallic body. Fermentation, the germ of decay and organic decomposition, miasmata and aromas, may even be comprehended by the same hypothesis. It is only necessary to disseminate the inactive principle, the neutral body, in the presence of certain other substances capable of being affected by it, and the resulting action takes place, leaving the inactive principle intact for future generation. But this property is more remarkable, and, perhaps, most practically useful in the action of animal charcoal or soluble organic matter.

An alcoholic solution of gum guiacum should be effected in the following manner:—½ oz. of pure solid gum in 10 ozs. of alcohol, sp. gr. ·830, four ozs. of distilled water to be added, which ought not to precipitate the gum. If such should take place, or should the mixture assume a turbid appearance, more alcohol must be added to render the solution clear, and the clear liquid decanted in stoppered bottles and *unexposed to light.* The test thus prepared is for the detection of ozone or *nascent* oxygen, the substance containing which under experiment for it should show a neutral reaction to test paper.

One hundred grains of fresh burnt animal charcoal may be now placed in a test tube; on to it a quantity of the test liquid is poured so as to about quarter fill the vessel, by stopping the aperture and slowly turning the tube over to expose the charcoal alternately to the air, and then covering it with the liquid contents of the tube, and repeating the operation about a dozen or more times, a slight but decided change of color of the test liquid will become perceptible; in some instances a longer time is necessary to indicate the same effect. Gum guiacum in a powdered state is of a nearly white tint when first pulverized, but on exposure to the air soon assumes a green hue. It possesses a strong affinity for uncombined or nascent oxygen in particular, becoming discoloured from its normal condition to a purple or deep blue when in combination with it. The alkaline permanganates and chlorates yield an equivalent of oxygen in contact with the gum, both being a solution, and give the characteristic purple tint. It is, however, destroyed in the presence of a free acid. Owing to its affinity for oxygen, the pulverized gum, as just mentioned, becomes green in contact with the air by combining with the oxygen therein. If the clear solution of the gum exposed to the air be observed horizontally under the surface, with the light coming in a perpendicular direction from above, a purple halo appears for a depth of about one-sixteenth of an inch, it cannot be detected when looked at from above. Freshly precipitated gum, from its solution by means of water or otherwise, if free from oxygen when precipitated, soon absorbs sufficient from the atmosphere to turn it green; the effects described hereafter should, for this reason, be observed shortly after the experiment.

Dr. Stenhouse and others have shown that animal, in common with other charcoal, possesses a peculiar property of condensing on its surface gaseous oxygen and converting it into ozone, and yet the ozone, which is known as a transmissible substance, is difficult, and if not impossible to separate in its normal state from the locality of its generation. The presence and actual contact of charcoal as a disinfectant is well known, and an instance scarcely exists in which the virtue of its properties has been known to affect their influence beyond the immediate proximity of the substance. The following experimental illustration may, however, show the fact more forcibly:—A long tube is filled with fine grained dry charcoal, and a current of atmospheric air passed slowly through it, on leaving the tube the air will be found to contain no greater quantity of ozone than previous to its entrance. If the charcoal be then moistened with spirit or water, still no additional trace of ozone will be found. The air, however, is neither deprived of any sensible amount of ozone, and yet the charcoal, during the process, possessed the full virtue of the ozoning properties. Under varying temperatures also no important alteration of weight is perceptible, for the substances are but mechanically mixed, and a slight disturbance would be sufficient to alter their composition on this assumption, and vary the proportion of gaseous ozone and charcoal. Independently of these instances it is impossible for a substance to exist in the pores or surface of the charcoal when employed as a filtering material and saturated with the liquid under operation, or if possible to exist, it could hardly be replenished when exhausted by constant usage. I have known instances where animal charcoal has oxidysed 262 grains of organic matter requiring forty-five grains of oxygen in an average of 150 gallons of water per day, for nine and twelve months consecutively, supplying it with three-tenths of a grain per gallon of gaseous oxygen without in any way having been exposed to atmospheric air. In more than one example, moreover, the charcoal was immersed in three feet of water, and the surface of such water was exposed to the open air and sunlight each day, circumstances favorable for speedily depriving it of any air it might naturally contain.

As to the source of ozone to furnish such oxidizable matter present in solution. It is uncertain whether it is obtained from the actual organic matter, or whether the mineral salts coexistant with it, take an active part in furnishing this element. If distilled water, after considerable exposure to the open air, be treated with the ozone test, no indication of ozone will be found to be present. If, on the other hand, water containing salts of lime, &c., be treated in the same manner, a very different result will ensue. The water seemingly increasing in its capacity for ozone in proportion to the quantity of the salts present. As might be reasonably anticipated, the least stable salt thus containing the oxygen necessary for furnishing the ozone, would be found to be affected after the process. Such actually takes place in practice by filtration. The carbonate of lime held as bicarbonate in solution is lessened often to the extent of two grains per gallon. Still more conclusive is the fact that a second filtration immediately afterwards does not reduce the salts. As a negative instance also of the direct virtue of the auxilliary salts, "rain-water" containing as it invariably does, organic matter, is found to be far more difficult to purify than water containing with it the average quantity of inorganic salts.

Such is the action of animal charcoal or soluble organic matter that, if the organism is perfect and affinities balanced, no reaction is perceptible. If, on the other hand, the forces of attraction are in a partial state of resolution, the animal charcoal taking to itself the oxygen of the compound, redistributes it into more simple and stable compounds. A subsequent analysis is found to yield a less oxidisable organic residue, slightly lessened by the amount of water and volatile gas, the product of the recombination.

To the chemical analyst it is a familiar circumstance to meet with certain substances combining with each other not by mechanical mixture, not sometimes even in solution, but which in other cases unite with avidity forming compounds impossible otherwise to effect. The simplest type illustrative of this principle is in the gases oxygen and hydrogen in mixture. So long as they remain undisturbed and maintained below a fixed temperature no change is known to take place. Chlorine and hydrogen when unexposed to light, sulphur again and oxygen, nitrogen and oxygen, carbon and oxygen, each may exist mixed or in contact, without any change taking place, but should one or both elements of any of these combinations be freed by any cause from a chemical combination in the presence of each other, a secondary compound is at once created. Such is water, such is muriatic acid, sulphuric acid, nitric acid, and carbonic acid, such in fine are all the numerous organic compounds, with which chemistry abounds, and the ultimate cause effecting the majority of inorganic combinations.

Ozone is a substance admitted by all authorities as partaking of the general properties, but differing in certain respects from oxygen. Ozone is oxygen, but oxygen is not necessarily ozone. Ozone is the oxygen of combination, whether fixed in substance or free. When in combination it is satisfied, and loses all its characteristics of ozone. When freed it is oxygen possessing all the energy of combination without the power of reconstitution. But oxygen is not the only substance capable of being rendered nascent by the catylictic presence of a third body. It is to this property the combinations alluded to already are due, and every element possesses the same property when newly freed from a recent combination.

Now, those substances, possessing the capacity for oxygen and combining with it, are called oxides or acid; other substances, although possessing the affinity are not capable of uniting chemically with oxygen, but converting it into ozone. Three bodies, A B C, are present; between A and B the affinity may be represented by 4, and are in combination; between B and C there exists an affinity represented by 3; between A C by 0. A B and C may therefore be in mixture together, and the compound substance A B will be reduced when in presence of C to 1, in its absence 4. If now another substance D, bearing an affinity to B equal to 2, and to A and C to 0 be added. When C is present D will decompose the compound A B by the superior attraction it has for A; in its absence the whole series will remain unaltered. Ozone, present in uncombined state is characteristic of the body B.

Those substances ozonizable which have a capacity for free ozone, as just described, like animal and other charcoal, platinum and other bodies. The alkaline permanganates and chlorates and like oxygen yielding bodies are ozonized. All oxygen possessing, including organic and decaying bodies, are ozonized, for, under some circumstance, they may yield oxygen in a nascent state, that is, ozone.

It is possible as referred to already to furnish ozone simply—first by the decomposition of any substance containing oxygen in combination; second, to ozonize the oxygen of the atmosphere by animal charcoal or some other substance of which this may stand as a type; and thirdly, there is another and more important means of obtaining ozone employed by Nature in providing the atmosphere, the grand reservoir with that consential element. Water seems to bear the most intimate affinity for ozone. The atmosphere is known to contain it through the vehicle of moisture. It is found more plentifully on the face of the ocean, rarely in a covered and sheltered situation, never in an inhabited dwelling. Being an active principle, its energy is quickly concentrated and expended in the numerous ways Nature has ordained for its mission. How, then, is the supply maintained to compensate for the loss thus sustained? As it is found in the presence of moisture, so it is generated by the moisture, by the vaporization perpetually going on at the surface of the ocean by the constant evaporation on the whole extent of the globe is maintained at a uniform quantity. But to verify this by experiment: the evaporation of ether by a heated glass-rod, furnishes a copious supply and will even sustain contusion with platinum wire; the ozone test, solution of guiacum, if quickly dried on the surface of paper affords the characteristic indication of ozone in becoming green. But the following perhaps is a more conclusive experiment as to the generation of ozone by evaporation.

The test tubes, similar to those before alluded to, should be nearly filled with distilled water. In one case use water which has been exposed in the open air for a considerable time, say two or three hours, in the other case water which has been recently boiled. The ozone test should be applied to both at the same temperature. The result will show a prevalence of ozone in the water that has been subjected to quick evaporation by boiling, while in the other the unboiled sample precipitation of the gum will take place uncoloured, indicating a total absence of ozone.*

The accepted theory of ozone among chemists is as of an active state of oxygen, and like the elementary principles of electricity, it is never generated otherwise than accompanied by a corresponding or induced quantity of another opposing element, *antozone:* although opposite and unlike in their nature, evincing properties positive and negative, yet having a strong affinity for each other, they combine and become neutral when opportunity offers; and, in fine, bearing out their semblance to electric phenomena still more intimately, they may be again isolated, as just shown, by—1st, chemical decomposition; 2nd, structural arrangements, as in magneto-electricity; and 3rd, by re-combination and disturbance of form, as in frictional electricity. The Franklinean theory as to the actual presence or absence of a single principle, or the more recently accepted notion of the compound constitution of a subtle fluid here also equally applies; and the question arises, do there exist two distinctive elements—ozone and antozone? Or are these effects attributable to the intensity and relaxation of a simple primary principle? By evaporation certain liquids may be ozonized, and the law applies equally to many others besides water, and ether. In the last experiment we generated an amount of the active element—ozone, and may reasonably anticipate a corresponding absence of this, or an induced proportion of its coeval principle; let, therefore, the same experiment be repeated in the following manner:—Place in a boiling flask one ounce of distilled water as before; some test paper must then be prepared as follows, a sheet of ordinary writing paper is to be saturated with the alcoholic test-liquid of gum guiacum and quickly dried over the flame of a spirit lamp, the colour of the paper should assume a light green tint. A strip of this paper is to be inserted into the neck of the flask, and the whole placed on a sand bath and moderately heated up to the boiling point, ebulition may be continued, care being taken not to wet the test paper. The contents of the vessel will be in the following condition, as the test paper will show; the vapour is absent of ozone, or in other words, the presence of antozone is indicated by becoming discoloured or deprived of the amount of oxygen it previously held in combination; the water on cooling as before would indicate the presence of ozone, but they have been but mechanically separated, by quickly shaking the contents the opposing principles will combine, and testing the same when cool a very dissimilar effect will be apparant from that previously described, little or no ozone being present. In condensing, the vapor gives up the antozone and neutralises the excess of ozone in the liquid from which it was derived; in the presence of the atmosphere it however behaves otherwise, ozonizing the oxygen thereof in condensing, it yields a large amount of nascent oxygen evident to the test-paper described. With ioidide of starch, another test for ozone, similar indications ensue.

The fact may be still further verified. Four ounces of distilled water, unboiled as before, is to be prepared by adding one drachm of test fluid, the gum of which will be precipitated and render the solution of an opalescent tinge; two similar quantities of this compound solution are to be placed in two similar test tubes, to about a quarter fill the same, one is to be corked, allowing a small vent aperture for expansion, the other, as previous, should have a strip of green test paper inserted at its mouth and otherwise left free from evaporation; both are now to be placed in a sand bath and gently heated; they will gradually, but decidedly, be observed to change from white to blue, of deeper intensity as they reach a certain temperature, about the boiling point, the may then be stopped. The colour is indicative of an excess of ozone in both. The test paper shows an absence of ozone in the vapor of one, but in the other instance both vapour and liquid are confined; and if each bear opposite properties, by com-mingling them a neutral result must enevitably ensue. Such we find to be the case; but in order that the experiment may be satisfactory, the stoppered tube should be allowed to cool, or to be artificially cooled by a stream of water, and in that state shaken to condense the vapor in the liquid. Comparing this with the other, although not devoid of colour, it is little indicative of free oxygen, the quantity lost by evaporation through the vent aperture or otherwise. And, further to prove that the gum is not structurally altered, it may be deprived of all the oxygen it contains by a deodorizing agent, sulphurretted hydrogen. As an incidental observation, it may be noted how large a quantity of sulphuretted hydrogen is required to deprive the gum of its oxygen when oxydized by ozone.

Water, then, in itself, may give rise to ozone, and inductively to antozone; why it is that certain liquids should become ozonized—why they should suffer partial decomposition, for it is only those substances which contain oxygen—in combination with another opposite element, that are capable of so doing, cannot be said with any amount of certainty. Oxygen is materially heavier, denser, than hydrogen, in the ratio of eight to one. When in combination the action of heat in a lesser form, such as to raise it to 212°, is as of a partial disturbance of its constitution; the

* The simplest manner of performing this experiment is to pour about one drachm of the water into a narrow test tube and add about ten drops of test liquid, the gum in which will be precipitated of a characteristic white, its normal color, or green, in intensity according to the amount of ozone present.

effect of this is, that the hydrogen probably absorbs and becomes satisfied with heat in one-eighth of the time necessary for accomplishing the same effect on the oxygen, it becomes, during the full accomplishment of this process on the oxygen, partly volatilized. Hence, in the vapor is found the hydrogen or antozone principle, in water the ozone. Under microscopic examination the decomposition of water by voltaic electricity presents an appearance confirmatory of this theory, the gases being freed much in the same manner as here described.

In this wonderful generative agent—viz., evaporation is the vast supply of ozone maintained in nature. In the evaporation consequent upon rainfall, that constantly saturates the face of the earth, and from the condensation of the vapor generated therefrom, is animal and vegetable organism nourished and sustained. Organized substances in generation and decay, in health and disease, require ozone for their developement—in the one case for the cellular secretions and constructing the animal tissue; in the other, for the full and speedy oxidizement of the germ of decomposition. The combinations, moreover, ozone effects with healthy organism in the part of food is striking, and worthy of observation. The gluten of wheat, milk, potato, and many other essential articles of nutrition are abundantly impregnated with free ozone, as may be detected by gum guiacum (Brande). Truly, we may observe, that this is another instance of an all-wise Providence for the sustenance of our being. What is more bountifully supplied us than water? What a more faithful minister to our wants? But in it we also possess a tender guardian, gently abstracting from its bosom the very essence of life; and still more gently, day by day, feeding the tender plant, and satisfying the thirsty forest with their daily wants —breathing to us the very spirit of life—and even then its mission is not expended; it is finally ordained to enshrine, as in a pall, the deadly putrefaction, fatal and yet co-existent with such grandeur.

The active energy of ozone in the atmosphere may be directly observed in many ways in its prejudicial behaviour to artificial and manufactured products. Metallic substances, iron more especially, quickly becomes oxidized if alternately exposed to water and the atmosphere, owing to the generation of ozone. Water boiled in iron vessels is known speedily to destroy such by continual rusting; the decay of stonework and timber may be equally attributable to the same cause. In the natural purification of water, evaporation and the generation of ozone thereby is prominently manifest; the soil through which the water percolates consisting of an absorbent material and possessing no actual ozonizing properties, simply brings the liquid into more intimate contact with the air and promotes evaporation. On this principle the old systems of artificial filtration through gravel and sand, and other finely divided substances owe their virtue. From the foregoing remarks it is evident, also, that by boiling water containing organic impurity much becomes oxidised by ozone; but neither instance will bear comparison with the effects produced by animal charcoal.

Animal charcoal, or bone black, consists of carbon and phosphate of lime principally, but also in conjunction with many minor substances, of which carbonate of lime is the most prominent. To be of good quality it should present a dullish cast, and not suffer any loss from organic matter by exposure to a dull red heat in a closed retort. On ignition a purely white residue should remain; if clayey matter or metallic oxides be present they will be conspicuous on the surface after ignition, and the charcoal has, in all probability, been previously employed for filtering purposes. The proportion of actual carbon present in the average quality of animal charcoal is about 20 per cent. (Stenhouse), the remaining per centage consisting chiefly of phosphates of lime and magnesia. Newly burned charcoal is remarkable for its great absorbent power, both for gases and liquids. If a test glass be filled with water, a large quantity of fresh burned charcoal may be cautiously added to its contents without overflowing it.

In a freshly prepared condition animal charcoal is but a feeble ozonizer, not even bearing comparison with many other less important substances; but the curious and remarkable property of its ozonizing power is its increase of capacity by constant use. This may be achieved by being in contact for a long time with water containing large quantities of soluble organic matter. The material after such treatment presents a different appearance to new charcoal, being of a dead grey cast, much lighter in colour than when new, and it is entirely free from any surface powder that always attend new charcoal, and renders the liquid black on washing.

When investigating this property, it occurred to me that the same power existed equally in both old and new charcoal, but from the circumstance of new charcoal being invariably covered with a very fine powder, the pores on its surface were impaired; or that from this or other cause, it was prevented from absorbing the test liquid into its cells, and consequently calling a less area of surface into operation as an ozonizing agent. To ascertain the correctness of this view, I submitted equal quantities of new and old charcoal (by old, I mean such as had been used for several years as a filtering medium) to distilled water and spirits of wine alternately, for over a fortnight, taking precaution finally to thoroughly wash both samples in water. They were then dried at ordinary temperature, and tested for their ozonizing capacity. The new I found to bear but very poor comparison with the old for ozonizing power.

The next point of interest to ascertain was, as to which of the constitutent elements composing the charcoal, the property owed its origin first. Neither phosphate of lime, carbonate of lime, nor carbon, when in the form of wood, charcoal, graphite, or other state, is capable of ozonizing to any extent whatever, wood charcoal, however, taking slight exception to the rule. In substance, therefore, the constitutents are inert. Samples of good ozonizing animal charcoal, such as just descibed as old, were treated as follows:—1st, To incineration to expel the carbonaceous and volatile matter, leaving the phosphate of lime and earthy salts; 2nd, By digestion with hydrochloric acid to abstract the calcigeneous phosphates and carbonates; and finally, another sample was pulverised as finely as possible in a pestle and mortar. On testing each residue, the results showed their capacity, when compared with the original intact substance, was considerably impaired for ozone. Any material alteration, moreover, in form or substance, causes a proportionate lessening of its power, and even the accumulation of suspended organic matter arrested in the process of filtration, or of gum and resin on the surface, eventually determines a cessation of this property.

But the affinity to which this is attributable: it consists of that of the second order necessary for chemical combinations, as first set forth, and the condition governing its action is, that the substance possesses a surface mechanically fitted for the reception and retention of oxygen. The oxygen thus situated seems to evince all the energy of combination, but lacking that force necessary for the constitution of a new form. The action of this induced oxygen lies only in proximity to the surface of the charcoal, or other ozonizable substance to which it owes its origin. For the purpose of calling its energy into play, actual contact is indispensable. This is illustrated very strikingly in the ensuing experiment.* If coarsely powdered animal charcoal be intimately mixed with small portions of phosphorus, the great oxidizing power of the charcoal quickly determines the combustion of the phosphorus; again, should an accidental scrap of iron find its way into charcoal used as a filtering medium, an occurrence not uncommon, the metal becomes soon covered with a thick coating of oxide, which eventually cements charcoal and iron into a conglomerate mass.

Oxide of iron itself is an ozonizing substance; thus it is, that iron being a less oxidizable metal than zinc, becomes converted into rust on exposure to the atmosphere, in a considerably shorter period of time than the latter metal, simply from the fact that the oxide regenerates ozone, and hence, continuously supplies the combining oxygen to the compound. Most acids are ozonizing bodies—that is, possess the power of generating ozone: by this means they determine the oxidation of the base with which they combine. Zinc and iron are slowly oxidizable in water, if devoid of acid; but in the presence of sulphuric or nitric acid, owing to the ozonizing effect of such on the oxygen of the the water, speedily determines the oxidation of the metal, and forms a secondary compound salt.

Substances capable of ozonizing, as a rule, may be artificially produced by certain substances containing oxygen as an element, and capable of having such expelled by heat or other agency, without otherwise altering or destroying their structural arrangement. In organic and other natural products, this property is also often met with to a considerable degree.

Animal charcoal is of the class of substance in question—by depriving the organic substance in the process of burning of its combined oxygen, it becomes thus permanently ozonizable. This process of burning in practice is rarely, if ever, achieved in the first instance. Sugar-refiners, and others using this charcoal, find that after the second or third burning the substance is considerably improved in its filtering power. In the use of animal charcoal for filtering impure water, great caution is requsite in its proper selection and adaptation. If badly-burned charcoal be chosen, it will probably give rise to a numerous series of failures. A species of putrefaction of the uncharred organic remains is almost certain to set up in the locality of the defective parts, and soon by spreading, contaminate the whole of the charcoal, together with any substance in contact with it. We find instances occur, that water, after having been in contact with this substance, becomes actually less pure from the introduction of this extraneous matter. Such qualities of charcoal are actually useless for all practical application, and on the evidence of the tests before mentioned, should be scrupulously rejected.

The treatment of animal charcoal by re-burning, solely for this reason, is beneficial; for all others it is depreciatory to its virtue. The ozonizing capacity has been shown previously to exist in the combined substance, that each elementary constitutent was incapable of exercising this property and hence we may reason in proportion, that the balanced constituents are varied from their combination, so would the ezonising power be impoverished. Washing the dilute muriatic acid, and reburning, have been much used in the revivification of expended charcoal. The preference is now given almost exclusively in favour of the latter, but in practice they are both, after a certain time, incapable of effecting their purpose, and the charcoal becomes useless. In theory the failure is attributable to similar though opposite causes. By the treatment with the muriatic acid, the mechanically acquired matter that may be present on the surface of the charcoal is loosened, and the phosphate of lime and earthy salts, by being superficially destroyed, leaves a partially renewed surface of the charcoal for ozonic action. The carbon, however, is left in excess. In reburning, the foreign matter is charred, and part of the carbon of it, together with that of the charcoal, is volatilized. A new surface is here again exposed, but the phosphates and earthy salts are in excess, and the residual charcoal from the organic matter is introduced as a foreign element on the surface of the renewed charcoal; in course of time the excesses of these extraneously introduced substances determine the cessation of the normal virtue of the charcoal. Much waste and great amount of labour is expended in these fruitless restorations of old charcoal and freeing it from impurities

By certain of the experiments herein enumerated, animal charcoal has been shown by constant use to become improved. After a continued action on soluble organic matter for years the ozonizing power has been stated to have been increased. How great, then, the fallacy of submitting such to renewal, if, by that process, the standard of its ozonizing capacity be reduced to its original condition, or still worse, lessened, as above shown.

The defect of used charcoal has been sought after in the wrong direction. If the impurity consists of calcinable matter, such as suspended clayey substance, chalk, &c., burning is ineffective; if, on the other hand, from organic substance, other chemical means for its extraction should have been resorted to, and thus the acquired impurity abstracted, leaving the charcoal improved by the process of its action, and literally imperishable.

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(From the *Main Farmer.*)

No. 4.—Crystallography.

Among the curious things that meet our eyes every day, is the fact that many substances in nature assume a regular form. Thus, if you look at a mass of course salt, you will find the pieces in blocks or cubes. Thus, common salt crystalizes in the form of a cube, while saltpetre crystalizes in the form of a six sided prism. If you should take a crystal of common salt as large as the end of your thumb, and break it into a hundred pieces, each one of the fragments would have the same shape—that of a cube, showing that the internal structure of the crystal was regular throughout. Thus, we may now give you a definition of a crystal. A crystal is a substance having an internal regular structure, to which is sometimes super-added a regular external form. It is the tendency of the particles of all bodies, when left free to move among themselves, to assume a regular form. This tendency is not confined to mineral substances, for we see the same symmetry of form in plants and animals.

In plants and animals whose substances are under the control of the vital principle, their outlines are generally curved or rounded in form, while inanimate matter assumes plane surfaces and an angular form. This is the case with all mineral substances. Animal matter is an unstable compound, formed by assimilating materials within itself, and soon decaying when its elements are separated. A crystal, on the other hand, when once formed, is never destroyed, unless acted upon by external influences. Crystals that were made many thousand years ago, still remain the same where shut up among rocks. The moment a crystal begins to form, no matter how small it may be, it is a perfect crystal. A crystal of common salt no larger than the head of a pin, is a perfect cube. but if left in a solution of salt in water, particles of salt will be added to the different sides of the cube until it may be an inch in diameter. This is the way then that a crystal increases in size, by additions to sides. Thus, animal and vegetable growth is internal, while that of the crystal is external.

The same substance usually crystallizes in the same form, so that we generally determine the substance by its crystalline structure. Thus, common salt crystallizes in the form of a cube. So does iron pyrites, or *fool's* gold. Saltpetre on the other hand, crystallizes in the form of a long, slender crystal, having six sides. Common quartz crystallizes in six sided prisms, terminated by a six sided pyramid. Epsom salts crystallizes in four sided prisms, while alum crystallizes in the form of an octahedron, like the diamond, which also crystallizes in this form; hence alum crystals were formerly called *alum* diamonds to distinguish them from the real gem. A knowledge of these different forms enable us, frequently, to distinguish such salts as are harmless from those which are poisonous. Epsom salts resemble oxalic acid, the latter a fatal poison, but it may be distinguished from it by its different form of crystallization. It is by the form of the crystal that the chemist readily distinguishes between the different kinds of salts and minerals that constantly present themselves to him.

No chemist has yet been able to tell us with certainty what is the shape of the atoms of bodies, but it has been inferred from the shape in which crystals are formed, that they are composed of three different forms, the *spherical* atoms which serve to make a cube and other similar forms, the *spheroidal*, for the square prisms, and the *ellipsoidal* for other forms. The different geometrical forms of crystals are very great. Those of carbonate of lime alone number more than six hundred secondary forms.

In order to make a regular crystal, it is necessary that the substance be in a liquid or gaseous condition, so that the particles can move freely among themselves. Sometimes we may make crystals by melting a substance and then cooling it. You can perform a pretty experiment with sulphur. Fill a teacup with sulphur or roll brimstone, and melt it and set it away to cool till a crust is formed over the surface. When you break through the crust and pour out the portion not yet cooled, there will sheet out on the inside of the cavity, beautiful crystals of sulphur. Gently heat the cup again so as to detach the whole mass from it, and carefully break it in two parts, and you have a beautiful specimen of crystalized sulphur in long, slender prisms. But we will wait till another week before we tell you all we have to say about crystals.

No. 5.—Crystallography Continued.

Among the most familar crystalline substances is common salt. We have already shown that its form is that of a cube, but there is a peculiar shape which it sometimes takes, known as the hopper-shaped crystal. When you evaporate salt water very slowly and in a quiet position, regular cubes will be formed, but if you evaporate it rapidly or agitate it, the salt will be in the form of irregular crystalline grains; salt obtained by rapid evaporation in boilers appears in this way. When the liquid is quiet and evaporating slowly, little cubes will form on the surface of the water and unite together forming one crystal, which gradually sinks and enlarges as it descends till it forms the hopper-shaped crystal. You can pick them out of almost any coarse salt bin.

Sometimes you may make crystals by just changing a solid or liquid to a gaseous state, and then allowing it to cool. Take two or three grains of iodine, put them into a glass vessel,—a Florence flask is the best,—and apply the gentle heat of a lamp, when a beautiful violet vapor will arise and fill the vessel, which on cooling will be precipitated on the sides of the vessel in small, dark colored crystals. Solid camphor will evaporate in a glass jar and then crystallize on its sides. Sulphur and arsenic will crystallize on the sides of a vessel in the same way. It is said that on a certain occasion at an eruption of a volcano, the lava run through a church, when the sulphurous vapor arose and crystallized upon the ceiling of the church.

The vapor of water or from the breath which lodges on a cold window assumes a crystalline form. However fantastically they may appear, they are all governed by the same law, and arranged against each other at the same angle. In this way snow crystallizes in a great variety of forms. When the snow falls very quietly you may collect them on a smooth surface and examine them with the naked eye. More than six hundred crystals of snow flakes have been examined.

The more slowly evaporation takes place, the more perfect are the crystals. If you dissolve a quantity of alum, or blue vitriol in water nearly as strong as you can make the solution, and then set it in a quiet place, there will soon begin to form regular crystals, but few in number. After a time turn these crystals over, or put them into a new solution, and you will have large and elegant crystals formed. It is on this principle that the alum basket is formed.

There are many curious things in nature and art, which receive their explanations from the laws of crystallization already explained. Iron is one of those substances which assumes a different form from crystallization. Wrought iron is tough and fibrous when first made, but when it has been subject to blows or constant vibrations, it changes its fibrous to a crystalline form, and becomes brittle. Hence it is not considered safe to fire a cannon more than six thousand times, because the structure of the metal becomes changed by firing. Rail-car axles become britttle from the same cause. An anvil has been known to fly to pieces on the same principle.

Another curious fact nearly allied to the principle just stated is, that some bodies, which are not crystalline, will assume a regular form while still in a solid state. Glass will, by long continued heat become crystalline while yet solid. Brass will become brittle by repeated heating and cooling. Hence brass wire will be tough at first, but afterwards become brittle and useless. Sugar candy which at first was transparent will after a time become opaque and crystalline.

Sometimes we may separate different salts from each other by crystallization. Take a little copperas, dissolve it in water in a cup, then a little blue vitriol dissolved in the same cup. Put the cup where the salts will crystallize, and the copperas and blue vitriol will be in separate crystals. It is on this principle that different minerals crystallize in the same rock.

The freezing of water is the result of crystallization. When water is perfectly still, it will remain several degrees lower in a liquid state than when agitated, but if in this condition it be suddenly disturbed it will instantly shoot into crystals. We once knew a small mill-pond to be frozen up in this way. The miller hoisted his gate on a very cold morning. The water commenced to run and set the wheel in motion, but in a few minutes the water ceased to flow and on examination the whole pond was in the condition usually called slosh. The agitation of the water had changed it to a crystalline mass.

Bodies change their specific gravity by crystallization. Thus water is expanded about one-ninth its volume when changed to ice. It bursts our pumps and aqueducts and rends rocks asunder. A British officer a few years since, filled strong bomb shells with water at Quebec, and froze it and burst the shells. By virtue of this principle type metal is made of an alloy of lead and antimony, which expands in the mould, and leaves a sharp edge. On the other hand gold, silver, lead and copper shrink in the mould and leave a rough surface. Look at an old-fashioned Mexican or Peruvian dollar which has been cast in a mould, and you will see the difference.

Sometimes bodies assume a crystalline structure without having a regular external form. Granulated sugar, and statuary marble are examples. Sometimes they appear laminated as in isinglass, and sometimes fibrous as in soap-stone, and the mineral asbestos.

Such are some of the wonders of the world as seen in crystals. A great variety of substances is produced for the use of man by virtue of this principle. Every substance has a different form of crystallization so that any person can recognize their differences, Simplicity and wisdom are manifest in the construction of everything in nature, showing infinite skill in the Creator who fashioned these things after his own will.

"THE GOOD OLD TIMES."

The Rev. Hugh Stowell Brown, of Liverpool, recently delivered a Lecture in Dumfries, on this Subject; in the course of which he compared the present with past centuries of the worlds History. He said:—"Men did as wonderful intellectual feats 2,000 and 3,000 years ago as are done in the present time. If it be true that man was only an improved gorilla, we don't find that he allowed a greater resemblance to it then than now: for his own part, he believed there were more monkeys now than then, and possibly the gorilla might not so much represent the race from which we sprang as the destiny to which we are hastening. Abraham he believed to be as thorough-bred a gentleman as any in the nineteenth century; Jacob as good a man of business as they would find on the Liverpool Exchange; while Joseph was a statesman, and Moses a legislator, worth a great deal more in their time than all our lords, commons and town councils put together.

"We think we do all things on a grand scale, and a cockney will boast that the largest theatre in London will hold four thousand people; thirty thousand would have scarcely filled the Coliseum at Rome. St. Georges hall, Liverpool, is justly regarded as a very magnificent building, but it was only a reproduction of a very little bit of the baths of Diocletian, which were nearly a quarter of a mile square, the whole structure being a great deal larger than our houses of Parliament. Some moderns say if the people of the ancient times should revisit the earth, they would be very much astonished He had no doubt they would, but he would be very sorry if they did in case they only laughed at us. Possibly, our grandfathers who lived in that stupidest of all centuries, the eighteenth, would be astonished, but not the men of two thousand years ago.

"We thought we had made great progress in military science, but believed we were at a disadvantage compared with the ancients. In Rome alone there were 800,000 public baths, and it never had more than half the population of London. They had hot, cold and vapour baths, and something like our Turkish baths; and what was better still the people constantly used them. We boasted of our civil engineering, but it was questionable if it had advanced much since the time when the Romans built their aqueducts, which were carried over valleys, supported on thousands of arches, or tunnelled for miles through the solid rock, while the greatest scientific skill was required to give the supply a proper grade.

"There was a great deal of talk about that wonderful triumph of genius, bringing the water of Loch Katrine to Glasgow, but the quantity of water delivered to every inhabitant of Rome was ten times the water supplied to London. An abundant supply of water was a special characteristic of ancient cities. We often read of the inhabitants of a besieged city suffering from hunger, but rarely, if ever, from thirst. And there was no overcrowding. Nineveh contained 600,000 inhabitants, but the population of London was, for its area, five times as dense as that of Nineveh. The ancients did not allow the dead to be buried within the walls of their cities—a practice only beginning to be abolished with us. In point of cleanliness, also, they were more careful than we are. He read the other day of some people taking cholera from washing the clothes of persons who had died from that malady. According to the Mosaic law these clothes should have been buried. Moses would not allow the people to live in houses that were unhealthy, but it was no use turning the people out and allowing the house to stand; he knew people would live in it if it remained, and so he said:—'Down with every stick and stone of it'

"In the matter of sewerage, the Romans were superior to us. The city was built on arches for the purpose of complete sewerage, and there yet remains a sewer in Rome so wide that a cart loaded with hay might pass through it. Excellent and well contrived drains have been discovered in Nineveh and other towns. The refuse of the cities was burned in the open plains. The hand-looms of thirty thousand years ago produced cloth of as fine a quality, in point of texture, colour and style, as we can produce; and the Hindoos, and some of the Africans, knew the process of manufacturing iron and steel, which led them to look with contempt, and to reject as rotten, the specimens of those metals which we sent them In all these points the past compared favourably with the present.

"No doubt the present had its achievements. It has the printing-press and railroads, telegraphs and extensive manufactories. He believed that its superiority consisted more in the greater power of production, and in the wider diffusion of wealth and knowledge than obtained in the past, rather than in the intrinsic excellence, or beauty, or brilliancy, or depth of what it did or achieved."

HEAVY PETROLEUM OIL.

In the distillation of crude petroleum oil, the first product that comes over is a very volatile and inflammable spirit, which is usually rejected as being too dangerous to store; the next product is paraffine oil, and it is to the admixture of this oil with the light inflammable spirit that most of the explosions of paraffine oil are to be attributed, and this seems to arise from the manufacturers wishing to obtain the greatest yield possible of the saleable oil, or in the distiller inadvertently raising the heat before all the volatile spirit has passed over. When this is carefully attended to there is but little danger of any explosion with paraffine oil. The residuum is composed of scales of paraffine and what is called heavy oil. The paraffine being extracted, there remains the heavy oil. As yet but little use has been found for this heavy oil, for it cannot be burned in lamps on account of the imperfect combustion of the excess of carbon it contains. From the crude oil 60 per cent. of paraffine oil is obtained, 4 per cent. of paraffine, and 16 per cent. of heavy oil, and there is 20 per cent. of waste. At present this 16 per cent. of heavy oil cannot be considered as anything but waste, as there is as yet no sale for it. But great efforts are being made to utilize this heavy oil. We believe that Mr. Lavender, at the petroleum works, Belvedere, is exerting his ingenuity to turn it to account: he is making it into what he calls grease, to be used as a lubricant. Of course that is only a name, as this heavy petroleum cannot be made into veritable grease. We suspect it is simply a kind of saponified emulsion of petroleum, made by a strong solution of alkali, and, if the price that it is to be sold at can be taken as a guide, that alkali is caustic soda. We do not say that this is that gentleman's process, but merely say that in this way it may be done, by first dissolving a little gum resin in the petroleum; it would then unite with caustic alkalies and caustic lime and form the emulsion above referred to. Such an emulsion at any rate would make an excellent lubricant, much superior to any crude grease, as all grease becomes rancid and then contains what are called the fatty acids, which attack metals, and are apt to do much damage to machinery; whereas this lubricant being alkaline will not oxydize, and, in in case any matters should get into the petroleum that will acidify, the alkali will neutralize that acidity.

A strong solution of caustic soda itself is an excellent lubricant, and is being extensively used instead of soft soap and water for planing, boring, and turning metals. Doubtless this lubricant, if so made, will take the place of the caustic soda when mixed with a little of the heavy petroleum, and it will be quite as cheap and not so hurtful to the hands and clothes of the workmen. For different kinds of machinery it can be thinned in this way to the proper consistency. For railway carriages the thick emulsion would be about the proper consistency. For this lubricant it is reasonable to expect advantages that cannot be derived from ordinary grease or oil, namely, that of preventing heating in a great measure. It being somewhat of a volatile nature, any tendency to heating would be counteracted by the volatization of the lubricant, and this in a lubricant is an inestimable property. As a lubricant, perhaps the most of the heavy petroleum may be used; still that is not the most profitable use to which to apply it. Its proper use is as a light and heat giving material. We think that we could suggest a way of using it, at least as fuel. Let it be first ascertained the amount of hydrogen required to unite with it to turn the whole into carburetted hydrogen gas, that will thoroughly consume without leaving any solid residue. Then heat the oil in contact with hydrogen, and the two would unite and pass off through the jets in the furnace as a highly calorific gas. The apparatus could be so arranged that a store of gas could be retained to commence with, and when in action it would not only generate its own hydrogen but distil over the petroleum in contact with the hydrogen to supply the heat—that is, it would be a regenerative gas furnace. The hydrogen could be obtained in this manner. A current of steam being passed through scraps of old iron kept at a red heat, would oxydize the iron and set free the hydrogen of the vapor to be used as above stated. To produce 1 lb. weight of hydrogen, 28 lbs. of scraps of old iron would have to be oxydized. Now it takes about 100 cubic feet of hydrogen to weigh a pound, and that is a considerable volume, and we should think that 28 lbs. of old ir. n would not cost more than a shilling. Further, the pure carburetted hydrogen might be used for lighting purposes, and would be infinitely superior to anything we know of in the shape of coal-gas. It would be equal in every respect to resin gas, and we remember well the brilliant white light that gas used to give—no soot and no sulphurous acid fumes. Of course, for the general manufacture of gas it could not be used—the supply is too limited; but wherever it might be used as a fuel, there it might be used also for lighting.

Then the question arises as to price. Could it be used with economy in lieu of coal. Well, the better kinds of petroleum are being attempted to be used, and it is said they can be used with economy, and if they can this certainly can, for it is a by product remaining after the manufacture of other valuable products. The great thing aimed at hitherto has been a lamp to burn this heavy oil. but no success has hitherto attended the efforts of the ingenious; but, doubtless, there will be, and it would be a great triumph if we were to be enabled to make our own gas on our tables as we required it. We do not despair of even that. Would not that humble the gas monopolists? We have been talking for some time about the exhaustion of our coal-fields, and here is some little hope for us in the produce of the oil wells and the distillation of shales, and, no doubt, long before that dreaded exhaustion arrives many other sources of light and heat will be discovered. We are aware that attempts have been made to burn heavy petroleum in furnaces, and with somewhat of success. This has been obtained by a sufficient blast to thoroughly burn up the carbon, by bringing an excess of atmospheric air in contact with it while in combustion. Mr. W. Young has attempted to utilize some of the first volatile spirit that first passes over in distilling bituminous coal and shale. He caused this volatile vapor to pass back again into the still, towards the end of the distillation of the coal or shale, that it might take up some of the carbon and come over in the form of easily condensible and-non volatile oil. He took out a patent for this process in connection with a Mr. Brash; but we suppose not having found the thing to succeed to their expectations they abandoned it. Theory and practice do not always agree, but do not let the half-informed cry out against theory on that account, as is their wont. Sound theory must precede and guide all successful practice.—*Mechanics' Magazine.*

The great desert of Sahara is in process of transformation into a garden. Every day new oases are produced by the multiplication of artesian wells which supply vast quantities of water.

PETROLEUM AS STEAM FUEL.

This important subject is still occupying the attention of experimenters, while the scientific and the commercial world are looking on with interest, and not without hopes of its ultimate success. The same may be said of the Americans, but their Government evinces a more active interest in its success, while an influential company is at work acquiring and thoroughly testing the comparative merits of every patent brought out. We have all along recorded the experiments conducted here and in America, and now, after a short interval, we find both countries renewing their efforts. Colonel Julius Adams, who has for years directed his attention to the best mode of substituting oil for coal in marine and other boilers, has not relinquished his project. He lately memorialized the Chief Engineer to the American Navy for an appropriation of 5000 dollars to be applied to a new series of experiments by the Petroleum Light Company of New York. The tests will be made in the Brooklyn Navy-yard, and, according to American newspaper accounts, the difficulties in the mode of burning petroleum in England are supposed to be obviated by American inventions. Be that as it may, we know that the eyes of all who hold an interest in an oil well, a refinery, or even a shale pit, are looking upon what is passing with only such anxiety as can be experienced by those who cast their chances upon trade which has turned out worse than profitless, and which would be at once redeemed were some means of consumption found for the glut of heavy oils which are upon the market.

By far the most important experiments ever conducted in England in connection with the substitution of mineral oil for coal as steam fuel took place on Saturday last in the yard belonging to the Canal Iron Works, Millwall. The experiments were made under the direction of Mr. Barff, of Glasgow, part proprietor of the patent taken out early last year by Messrs. Sim and Barff, of that city. The simple principle involved in this patent, as named in the illustrated description of it published in *The Oil Trade Review* of July 7 last, is the placing within the fire-box a furnace of an ordinary locomotive, marine, land, or other boiler, a generator, in which hydrocarbon or even animal and vegetable oils may be admitted. The generator is heated to a low red heat, and the oil is then admitted in a small continuous stream or evenly regulated drops. The oil is, of course, converted instantaneously into a permanent gas, and, being burnt as it comes off, creates an intense heat. In order that the surplus carbon deposited in the retort may be economised, a jet of stream is introduced, and the decomposed water mixes with the hydrogen and oxygen of the water. making the combustion perfect.

Mr. Barff, since our last notice of the patent has been almost daily engaged in perfecting the application of his patent. Twice has he propelled a vessel down the Thames by liquid fuel, and for several weeks a boiler has been under trial at Millwall. On Saturday last, the experiments were of a semi-public character, and the following gentlemen were present: Col. Goodenough, Major. Goodenough (Royal Artillery), Capt. Blane, R. N., Capt. Thorp, R. N., Capt. McKillop R. N., Capt. J. Vine Hall, Capt. Luckie, James Samuel, C. E., Mr. J.

Davis (naval architect), Mr. W. Vavasour, A. E. Eastwood, Esq.

The boiler, which was rather an old one, imperfectly adapted to the purpose, and with incomplete arrangements for providing a thorough draught, did not exhibit Mr. Barff's principle of working to the best advantage. Nevertheless, the visitors were much interested in the experiments, and they undoubtedly served a good purpose. The material employed was our home-made shale oil, which was conducted by a small supply pipe from a reservoir above to the red-hot internal surface of the generator, which is fitted up near the front of the boiler, and a sufficient interval having been allowed between the drops to permit the surface to recover its red heat, the greater part of the liquid was at once converted into gases identical with some of those ordinarily generated by coal. The boiler was supplied with a jet pipe bent, in order that there might be no return, through which the liquid was allowed to flow into retort. The result was that in three minutes 5 lbs. of steam were generated, the rate of evaporation obtained being very high—viz., about 22 lbs. of water to one of oil, or in a proportion of four to one as compared with ordinary steam coal. Until the steam reaches 10 lbs. pressure, the apparatus does not act, but so soon as this point is gained, all heavy smoke—which of course represents so much oil unconsumed—disappears, and the economy in the burning of the oil is apparent.

It is now some time since the public heard of the progress of Mr. Richardson's experiments, which, it will be remembered, have for some time been carried on under Government auspices, but have of late been left to Mr. Richardson's sole responsibility. We have now before us a printed circular of invitation to see the petroleum boiler at work in Woolwich Dockyard It appears that the Admiralty have given the patentee permission to exhibit his process for one week from Monday next, and, from what we hear, we have no doubt the attendance of those interested in the subject will be considerable. Mr. Richardson announces his intention of mixing other oils and oleaginous refuse with shale oil, so as to further lower the already low price of crude mineral oils. The plan may be worth a trial, but the main thing which it is essential for Mr. Richardson, or some other inventor, to demonstrate, is, that crude mineral oil can at its present price be effectively and economically substituted for coal as steam fuel. When this has been clearly demonstrated, it will be early enough to look about for additional saving. The precise profit or loss consequent upon the adoption of mineral oils as fuel cannot now be ascertained, but must be determined by the success or partial success of one or other of the inventions, and the consequent effect upon the market.

Reverting to Messrs. Sim and Barff's patent, it may interest our subscribers to know that a limited liability company is being formed in anticipation of its success, with C. B. King, Esq., as engineer. Mr. Bloxam, the well-known Professor of Chemistry at the Royal Academy, Woolwich, has, after a series of trials and inspections, given the patentees a report, which is really scientific and exceedingly interesting, if not practically useful. As to the effect of introducing steam into the generator, he says, when the petroleum, or shale oil, is allowed to drop into the red-hot generator, a portion of the gas thus produced is always decomposed by contact with the heated surface. The gas consisting of a large weight of carbon, united with a small proportion of hydrogen, the effect of bringing it into contact with the red-hot surface is to cause the separation of a considerable quantity of carbon in the solid state, part of which is deposited upon the inside of the generator, which it seriously obstructs, whilst another part may be seen in a finely-divided state, communicating a dark colour to the smoke accompanying the gases from the generator. The carbon thus deposited inside the generator is so much heat-giving material wasted, which ought to have been conveyed into the combustion chamber and there consumed. This is effected when steam is introduced into the generator, for the steam, consisting of hydrogen and oxygen, is decomposed by the red-hot carbon in the generator, its oxygen uniting with the carbon to form carbonic oxide gas, which is highly combustible, and burns in the combustion chamber where the heat is evolved; the hydrogen of the steam is liberated, and, being also a combustible gas, contributes its share to the heat produced in the combustion chamber. It is evident, however, that the additional heat produced in the combustion chamber by burning the carbonic oxide and the hydrogen obtained by the action of steam is not all clear gain, but is attended with a certain expenditure or loss of heat in the generator; and the question arises, whether the amount of heat gained in the burner, or combustion chamber, is greater than that lost in the generator.

Mr. Bloxam finds by calculation that when the gases burn in the combustion chamber so large an amount of heat is generated that a considerable surplus, or gain of heat, remains, after deducting the loss of heat due to the decomposition of the steam in the generator, as well as the heat consumed in raising the carbon and the steam to the temperature necessary to effect the decomposition of the latter (estimated at 2,000° F.). By calculation, each pound of carbon converted into gas by the action of steam in the generator represents a gain of heat sufficient to convert lbs. of boiling water into steam. Theoretically, this amount of heat would be gained independently of and after deducting that expended in raising the carbon and the steam to a red heat in the generator; but it must not be forgotten (in practice) that if a separate fire be employed for heating the generator, so much more fuel will be consumed than is required (by calculation) to heat the carbon and the steam, that the actual gain would be much diminished, and could, by bad management, be converted into a loss, so that it is very desirable that the generator of gas and the boiler which supplies the steam should be heated by the gas itself, and not by a separate fire. Even if the heat lost in the generator by the introduction of steam were exactly equal to that gained in the burner, the process would still be attended with the great advantage of removing from the generator the solid carbon, which forms a serious obstruction, and would interrupt the continuous working of the apparatus.

It appears to be desirable that the temperature of the generator should be maintained at a bright red heat, for at a lower temperature the oxygen of the steam would be converted into carbonic acid, and since this is not combustible like carbonic oxide, it would contribute no heat in the combustion chamber. If, however, the generator were too strongly heated, a correspondingly larger quantity of carbon would be separated by the decomposition of the gases, and the supply of steam might be insufficient for its consumption. By judiciously regulating the supply of steam, the corrosion of the generator by the combination of the iron with the oxygen of the steam, may be rendered of small account. The arrangement for heating the generator should be such as to prevent, as far as possible, oxidation by air admitted into the flue or furnace.

In the application of this mode of generating heat to steam boilers, the maximum evaporative effect ought to be obtained with greater certainty than when an ordinary coal fire is employed, because the combustible gas issues from the burner under considerable pressure, and thus helps to create the draught which is produced in coal-furnaces, almost exclusively, by the high temperature and consequent ascensional force of the products of combustion escaping by the chimney. To confer this, ascensional force consumes, it is said, as much as one-fourth of the heat generated in the furnace, since the temperature of the air as it escapes from the chimney must not be reduced below 600° F., or the furnace will not draw; whereas the impulse given to the gases issuing from the burner under consideration would probably allow the temperature of the escaping air and products of combustion to be reduced below this point. In all operations which are required to be suspended or arrested at any given period, a fuel of this kind, the supply of which may be discontinued at once, obviously possesses a great advantage over an ordinary coal or coke fire"—*Oil Trade Review.*

Machinery and Manufactures.

Artificial Leather from Leather Cuttings.

[A part of an article translated from the *Gerber Zeitung* for the *Shoe and Leather Reporter.*]

We are continually hearing of some new discovery or invention for the utilization of waste substances. The following clipping is from the American *Artisan*, and it certainly astonishes us not a little:—

"The parings and clippings of untanned hides, especially of those that come from beyond the Atlantic, are cut into small strips by means of a machine constructed for that purpose. The shreds when cut are soaked in water impregnated with strong muriatic acid, in the proportion of one part of the acid to one thousand parts of water. The temperature of the solution may vary between 15 and 26 degrees. The time that it must remain soaking depends on the thickness of the leather and the temperature of the solution; two days are sufficient if both the above are favourable, otherwise it requires four days. The strips, when thoroughly soaked, are washed in several waters, and then spread out on hurdles in the open air to drain off the water, and becomes somewhat dry. In that half-dried condition the minced leather is subjected to a double motion of two cylinders, the one with a tap, the other being railed. The effect of the motion upon the leather is to reduce it to a uniform stiff lump. This shapeless material is then deposited in a vessel or some convenient place, the temperature of which ranges between 15 and 24 degrees, where it is left for two days, only being stirred or turned over from time to time with a shovel, till it becomes glutinous and soft to the touch. A mixture is then made, composed of 95 parts of this material and 5 parts of a thick vegetable mucilage, obtained by making a decoction of wild lichens, and then letting the decoction evaporate. Or, the mixture may consist of 90 parts of the leather material, 5 parts of the above-named mucilage, and 5 parts of either hemp or some other downy thread.

Out of the above composition straps can be made of any length or breadth that may be desirable, by letting them pass through wooden or iron cylinders. The straps are first put upon lathes while in a moist condition; they are then plastered on both sides, first with fish oil and then with the following vegetable composition:—one part of wild lichens boiled in twenty parts of water, the decoction to be filtered and left to evaporate till it is reduced to a thick mucilage. To one part of this mucilage, add eight parts of train oil, 4 parts of palm oil, and 4 parts of cocoanut oil. The different oils are mixed by being melted over a slow fire, and, while yet hot, the whole is poured into the mucilage and mixed up therewith. The leather strips after being plastered over with the above composition, are left in a place of about 15 degrees temperature for some two or three weeks, till they have absorbed the moisture of the composition. Should there be any grease remaining, it is removed with a paint-brush dipped in soda-water, and pressed over the surface of the leather. The leather is now again made to pass through two iron cylinders, by which it is pressed and glossed. This artificial leather is rendering good service to various industries, since it may with safety be used for machine straps, trimming furniture, etc."

Bessemer Steel Rails.

It will be remembered that Mr. Moon stated at the last London and North Western meeting, in reply to a shareholder, that experiments were being made with a view to having rails with steel at the top and bottom of the rails, but iron in their body, which would effect a further economy in the use of steel rails. They would have that part of the rail exposed to wear, of steel, and that which is not subject to wear (for practically a rail is not worn down before a certain point) of iron. But this difficulty arose in carrying out the plan—the steel could not be thoroughly welded to the iron in the process of rolling, or so thoroughly that it would not loosen itself, when of course it was useless for train running. Success, however, has since attended the plan by adopting another method of connecting the steel with the iron. Instead of placing a plate of steel at the top and bottom of the pile to be rolled into a rail, there is now a connecting plate running down between the iron. The rail is steel above, and steel below, with the body of iron. It answers, we understand, perfectly, and its importance to railway companies may be estimated when we say that steel rails of this make will cost only £9 10s. to £10 per ton, or but £2 more than iron. Great economy will therefore be effected in the future working of railways with large traffics, where good iron rails used to be worn or knocked out in three or four months. Extending the life of the rail, as the steel rail does greatly, also means economy in the consumption of coal, and should be another warning to the croakers.—*Herapath's Journal.*

Tempering Steel in the Lead Bath.

EVERY person accustomed to heating steel for hardening in the common forge fire, knows how difficult it is to heat evenly any article that has a thick and thin portion, so that the thick part shall be evenly and thoroughly heated without overheating the thin part. Now, if the lead bath, heated to a proper temperature, be used, anything immersed in it, no matter how thin or how uneven the thickness, will be equally heated throughout.

A cast-iron pan will do to make the receptacle of the molten lead of which the bath is composed; but a black-lead crucible is preferable, if it be handled with care to prevent breaking; vessels made of malleable iron, however, are preferable to either the cast-iron pan or black-lead crucible. To prepare the bath, put the necessary quantity of lead in the vessel and bring it to a molten state; continue the heat until it shows a blood-red glow. As lead slowly oxydizes at a red heat, some precaution may be taken to prevent it, and then the loss will be quite small. This precaution may consist of a plate of iron, say about one-fourth of an inch in thickness and laid carefully upon the surface of the lead. where it will be sustained; a hole may be made in the iron in which the articles may be introduced to reach the bath underneath it; or in place of the iron plate, the surface of the bath may be covered with a layer of charcoal in the form of dust, or a quantity of wood-ashes will answer quite a good purpose. The debris and scrapings of the charcoal bin are just the material, and the only cost would be the trouble of collection from the place of deposit.

For thin cutting blades, razors, surgical instruments, springs, etc., this bath is especially adapted. The only care required is to keep the bath at the proper temperature, and see that the articles immersed in it are sufficiently heated. From the lead bath they may be chilled in either water or oil, as may best suit the purpose for which they are intended.

In some kinds of work it is necessary that one end or a certain portion of the article should be left soft. This is generally done by only hardening the part or portion necessary to be tempered, but by so doing much risk is accompanied in the operation by the article cracking at the water-line of the article when immersed, in consequence of the sudden contraction of the chilled article. A much better way is to temper it without regard to the part to be left soft, and then immerse this part in the lead bath and *draw it,* as the term is, to the required state. An instance of this application is the end of steel ramrods for rifles, where the screw is cut for the purpose of screwing on the wiper with which to clean the rifle. The rod is tempered the entire length, and the end where the screw is to be cut is immersed in the molten lead about the depth of an inch and left to cool gradually, and then no trouble is experienced in cutting the screw, which would be impossible or attended with the destruction of the cutting dies. It is sometimes necessary to soften portions of hard-drawn brass wire or steel wire that is used for springs, and to soften the whole spring destroys the necessary elasticity. If the ends of the springs are to be bent or rivited, the lead bath presents the necessary means of softening for that purpose.

We recollect having seen a process of tempering the steel springs of crinoline, by first running the flattened wire from a reel through the fire, and then into a reservoir of oil to harden it, and then passing it direct from the oil through a bath of molten lead. A reel and winch was the means used to draw the spring from the reel on which it was wound direct from the rolls through the triple baths of fire, oil, and molten lead; the judgment of the operator regulating the heat of the necessary fires and reeling it faster or retarding it as was required for the necessary temper.—*American Artisan.*

Staveless Barrels.

The *American Artisan* reports the following in the proceedings of the Polytechnic Association of the American Institute:—

"Mayo's patent staveless barrel was exhibited, and the mode of constructing it explained. It was made of thin slips of wood, similar to shavings, and laid up in form of cylinders; the slips crossing each other at right angles and running around a certain portion of the circumference of the barrel in a spiral manner, and fastened with glue and water-proof cement. This barrel was intended to hold coal oil, kerosene, gasoline, alcohol, etc., and had given proof of its efficacy, 12 or 14 thicknesses of the thin shavings-like slips being sufficient for the thickness of an ordinary barrel. Hoops were not necessary to hold the barrel together, but in some cases hoops were fastened to the inside circumference to strengthen it where much rough usage was anticipated. The inventor stated that a barrel had been filled with gasoline for several months, and it had not yet leaked a drop, there was no smell of oil, and it was almost impossible to tell that it contained gasoline. The weight of the old style of barrel is about 80 or 90 lbs., but this one weighed only 50 lbs. They had been subjected to a pressure of five tons across the bung, and a hydraulic pressure of 35 lbs. to the square inch, and did not give way. They were in fact about as strong as a steam boiler of the same size. They could be made for $2 50 per barrel. The inventor believed it to be the first great improvement in barrels, as no radical change had been made in a thousand years.

Monster Iron Shaft.

A correspondent of the *Globe* says:—Saturday last witnessed the successful working of a monster iron shaft, which Messrs. Gooderham & Worts have introduced into the water-wheel driving their flouring mills in this village. It is the invention of Mr. Roberts engineer. The shaft was cast at the foundry of Messrs. Hamilton & Sons, Toronto, where a cupola had to be built expressly for it, on account of its prodigious size. It measures 32 feet in length, in halves of 16 feet each, hollow in the centre and weighs about 11 tons; it has also the additional support of 4 pairs of large wrought iron girders ingeniously contrived which renders it so pregnant of strength as to seem almost invincible. This shaft is capable of supporting a wheel 20 feet by 20 feet, or of driving 8 or 9 run of stones with all the machinery attached. The wheel is built upon the shaft by means of iron flanges surrounding it, so that the strength of the shaft is not impaired. An immense pit wheel is mounted upon the end of the shaft weighing about 4 tons. The wheel will repay a visit to those interested in the mechanical improvements of the Province. The cost of the shaft delivered here was, I believe, about $1,100, which must have been nearly doubled in the putting in. Meadowvale can boast the largest and best shaft of the kind on the continent.

A Monster Bridge.

The "widest bridge in the world"—that which spans the Thames from Battersea to Pimlico—was opened on the 20th for traffic. According to the plans of Sir Charles Fox, the new structure has four river spans of 175ft. each, and two land openings at each end of 70ft. The river openings are segmental in shape, and the ribs of wrought iron have a rise of 17ft. The three piers in the river have each at the level of springing of ribs a thickness of 12½ft. and the two abutments are 20ft. each at that level, so that the total length of the whole bridge is about 310 yards. The width of the bridge at rails level is 110ft., wide enough for eight lines of rails, and this width is carried by seven main ribs to each span. The abutments have been carried down to a depth of over 15ft. below low water mark, with the brick work in cement, and the excavations for the abutments, owing to the width of bridge and form of ribs, had to be 125ft. long and 48ft. wide. The piers are supported by brickwork in cylinders, the latter, four in number, being sunk to a depth of 45½ft. below high water mark. Each is 21ft. in diameter, and made of cast iron in lengths of 8ft.; each length composed of eight segments. The length of each pier at the level of the cylinders is 130ft. The weight of iron in superstructure and cylinders, &c., is estimated at about 3,000 tons, 100,000 cubic feet of stone has been used; 16,000 cubic feet of brickwork, and about 300,000 cubic feet of timber. Each of the cylinders has been weighed with a load of 1,000 tons to test the foundations, and at low water mark cast iron girders fixed between them and the existing pier. The new bridge is about 52ft. wider than Westminster Bridge.

A resident of the island of Cuba proposes to use soda-water in the extinguishment of fires.

One hundred and fifteen varieties of Indian corn, each of which has a name, has been sent to the Paris Exposition by Wm. S. Carpenter, Esq., of the American Institute.

Practical Memoranda.

The Composition of Alloyed Metals.

Below are a few of the alloys commonly used in the arts:—

Chinese White Copper.—Copper, 40·4; nickel, 31·6; zinc, 25·4; and iron, 2·6 parts.

Manheim Gold.—Copper, 3; zinc, 1 part, and a small quantity of tin.

Bath Metal.—Brass, 32; and zinc, 9 parts.

Speculum Metal.—Copper, 6; tin, 2; and arsenic, 1 part: or copper, 7; zinc, 3; and tin, 4 parts,

Hard Solder.—Copper, 2; zinc, 1 part.

Blanched Copper.—Copper, 8; and arsenic, ½ part.

Britannia Metal.—Brass, 4; tin, 4 parts; when fused, add bismuth, 4; and antimony, 4 parts. This composition is added at discretion to melted tin.

Plumber's Solder.—Lead, 2; tin, 1 part.

Tinman's Solder.—Lead, 1; tin, 1 part.

Pewterer's Solder.—Tin, 2; lead one part.

Common Pewter.—Tin, 4; lead, 1 part.

Best Pewter.—Tin, 100; antimony, 17 parts.

A Metal that expands in cooling.—Lead, 9; antimony, 2; bismuth, 1 part. This metal is very useful in filling small defects in iron castings, etc.

Queen's Metal.—Tin, 9; antimony, 1; bismuth, 1; lead, 1 part.

Mock Platinum.—Brass, 8; zinc, 5 parts.

Ring Gold.—Pure copper, 6½ pwts.; fine silver, 3⅝ pwts.; pure gold, 1 oz. and 5 pwts.

Mock Gold.—Fuse together copper, 16; platinum, 7; zinc, 1 part.—*Scientific American.*

Expansion of Water by Heat.

BY DALTON,

Temperature.	Expansion.	Temperature.	Expansion.
12° Fahrenheit.	100236	122° Fahrenheit.	101116
22	100090	132	101367
32	100022	142	101638
42	100000	152	101934
52	100021	162	102245
62	100083	172	102575
72	100180	182	102916
82	100312	192	103265
92	100477	202	103634
102	100672	212	104012
112	100880		

How to Polish Wood.

Take a piece of pumice-stone and water, and pass repeatedly over the work until the rising of the grain is cut down. Then take powdered tripoli and boiled linseed oil, and polish the work to a bright surface.

To Gather and Preserve Woods.

Woods should be gathered and exposed in a dry situation, to a heat of from 90° to 100° Fah., until sufficiently dry. The larger kinds are more easily chipped before drying.

To Preserve Woodwork.

Take boiled oil and finely powdered charcoal; mix to the consistence of paint, and give the woodwork two or three coats with it. This composition is well adapted for casks, water-spouts, &c.

To produce Figures on Wood.

Slack some lime in stale wine. Dip a brush in it, and form on the wood figures to suit your fancy. When dry, rub it well with a rind of pork.

Heating Power of various Substances.

Of the Heating Power of various Combustible Substances, exhibiting the utmost quantity of Water evaporated by the given Weights, and the smallest quantity of Air capable of producing total Combustion. Dr. Ure.

Species of Combustible.	Pounds of water which a pound can heat from 0° to 212°.	Pounds of boiling water evaporated by 1 pound.	Weight of atmospheric air at 32° to burn 1 pound.
			Smallest quantity.
Perfectly dry wood	35·00	6·36	5·96
Wood in its ordinary state	26·00	4 72	4·47
Wood charcoal	73·00	13·27	11·46
Pit coal	60·00	10·90	9·26
Coke	65·00	11·81	11·46
Turf	30·00	5.45	4 60
Turf charcoal	64·00	11·63	9 86
Carburetted hydrogen gas.	76 00	13·81	14·58
Oil, Wax, Tallow	78·00	14·18	15·00
Alcohol of the shops	52 60	9·56	11·60

Another Solvent of Textile Fibres.

A solution of copper in ammonia is said to be a solvent not only for lignine, and thus for vegetable fibres generally, but also for animal fibres, as wool and silk; forming elastic water-proof substances, and capable of so penetrating one kind of fibre with a solution of another, as to unite certain of their qualities: for example, enabling cotton to receive and retain the same dyes with woollen, and with a similar tenacity.

Small Savings.

The parings of a bushel of juicy apples are said to yield a quart of cider by the aid of a hand-press. The honey that wastes its sweetness on the air around an acre of buckwheat in blossom, can be saved to the amount of fourteen pounds per day, according to the estimate of a German investigator. Rags can be saved to the value of $60,000,000, as shown by the paper statistics of this country alone.—*Scientific American.*

Coal Oils as Lubricators.

The American *Artizan* says: it is stated that American manufacturers, especially those employing fine machinery, have found by a thorough system of tests, that coal oils as lubricators are superior to sperm oils in the ratio of 100 to 84, a discovery extremely satisfactory from the great difficulty heretofore of obtaining regularly a grade of sperm or whale oil of uniform density free of gum and foreign mixture.

Tempering Steel.

At a meeting of the Polytechnic Association of the American Institute, Mr. Muller answered a question which was proposed by himself some time ago. How to harden small pieces of steel so as to retain a bright color corresponding with the degree of temper without spots of oxydation. The pieces are put in a box with Rose's metal; the latter is molten around them and the whole heated red hot, then cooled off by pouring water into the box. In tempering the pieces the Rose's metal is molten off again, and the composition of the latter can be chosen so that the melting point corresponds with the tempering temperature that was originally wanted.

To clean Marble Fire-places.

Marble fire-places should not be washed with suds; it will in time destroy the polish. After the dust is wiped off, rub the spots with a nice oiled cloth, then rub dry with a soft rag.—*American Artizan.*

Interior of Molds.

M. Ganz, of Ofen, in Hungary, coats the interior of his molds, which should be of iron, with a paste of finely-powdered antimony and alcohol, and then dries them at a temperature of 100 degs. Cent. The iron castings are thus covered with an extremely hard coating of the alloy of antimony and iron. *Ibid.*

Statistical Information.

The Quebec Relief Fund.

A Lower Canadian Journal publishes the following list of places and their contributions to the fund in aid of the sufferers by the recent calamitous fire in Quebec, by which so many thousands of persons were rendered homeless:—

Quebec	$ 56,136
Montreal	14,238
Three Rivers	205
Ottawa	1,765
Upper Canada	8,914
Rural Districts	17,002
United States	19,505
Prince Edward Island	1,172
New Brunswick	12,049
Nova Scotia	11,042
England and Scotland	210,960
France	934
Ireland	8,634
Germany	14
The Canadian Government	50,000
Total	$412,570

Besides the above there were contributed 12,000 pairs of blankets, and large quantities of grain, provisions, and general merchandize.

Canadian Railway Traffic.

The official statement for 1866 just published, shows that there are in all thirteen railways in Canada—eleven in operation and two closed.

The earnings of the eleven Roads were as follows:—

	Miles.	Earnings.
Grand Trunk	1,377	$6,639,260
Great Western	345	3,264,402
Northern	94	512,872
Brockville & Ottawa	86	111,086
Port Hope and L. & B.	64	178,512
Prescott & Ottawa	54	104,420
London & Pt. Stanley	25	35,490
Welland	25	106,944
Carillon & Grenville	12	9,969
St. Lawrence & Industrie	12	6,008
Total	2,094	$10,968,963

Joint earnings from passengers	$4,290,776
" " " Freight	6,221,108
" " Mails, Sundries	457,079
Total, 1866	$10,968,953
Total, 1865	10,793,378
Difference	$175,585
Earnings per mile, G. W.	$9,462
" " Northern	5,456
" " Grand Trunk	4,281

Emigration Returns.

During the season of 1866, the total number of emigrants landed in Quebec, *via* the St. Lawrence, was 28,648 against 21,355 in 1865; showing an increase of 7,293 souls—viz.: 4 in the number of cabin and 7,289 in the steerage passengers. Their sexes may be thus classified:—

	Cabin.	Steerage.	Total.
Males	876	12,010	12,886
Females	479	7,222	7,701
Children (males)	99	3,242	3,341
do (females)	82	3,010	3,092
Infants	28	1,600	1,628
	1,564	27,084	28,648

Distinguishing the countries from whence they came, the following results appear:—

	Cabin.	Steerage.	Total.
From England	1,247	5,988	7,235
" Ireland	153	2,077	2,230
" Scotland	164	2,058	2,222
" Germany		3,330	3,330
" Norway and " Sweden		13,506	13,506
" Other countries		125	125
	1,564	27,084	28,648

11,539 came by steamers, and 148 by sailing vessels. Of the former, 6,853 embarked at Liverpool, 2,214 at Londonderry, 2,213 at Glasgow, and 259 at London.

English	3,380
Irish	3,422
Scotch	2,074
Germans and Prussians	4,013
Norwegians, Swedes and Danes	14,968
Other Countries	791.
	28,648

And the trades and callings of the steerage male adult emigration are stated to have been as follows:—

Farmers	4,896
Labourers	3,888
Mechanics, Tradesmen, &c.	2,801
Professional Men	128
Servants (male)	4
Clerks, Traders, &c.	298
	12,010

The season's emigration may be said to have been of a remarkably healthy character.

Amongst the emigrants from the United Kingdom, but 8 deaths occurred at sea; while the mortality on board the ships from Foreign Ports bears a smaller percentage than ordinarily. Amongst the Norwegians, there were 73 deaths on the passage and nine in quarantine—together 82, or equal to 0.60 per cent.; and amongst the Germans 83 deaths occurred at sea and 10 at Grosse Isle, being 93, or equal to 2.72 per cent. —*Emigration Gazette.*

Rail Road Items.

Miles of rail-road completed in the United States	36,896
Increase during the past year.	1,535
Miles in Pennsylvania	4,650
" Ohio	3,401
" Illinois	3,250
" New York	3,025
Total cost of all the roads	$1,502,464,085
Average cost per mile	40,723
Miles of rail-road in 1828	3

Rolling stock of British railways:—

Number of locomotives, 1866	7,414
Passenger carriages	18,000
Other cars attached	7,000
Freight cars	220,000
Total number of locomotives, carriages and cars	252,414
Increase for the year	15,061

Life and Death at Sea.

The Board of Trade *Wreck Register* for 1865, gives the number of wrecks and casualties on the coast of the United Kingdom as—

	1,656
Annual average for 1855 to 1859	1,204
" " 1860 to 1864	1,483

The report says, "the general average number of casualties reported will probably increase from year to year, owing to the increase in the number of ships frequenting our coasts and narrow adjoining seas."

Nearly 1,700 of the 2,102 ships to which casualties happened were British ships. The number of ships exceeding the number of casualties recorded, is because in cases of collision two or more ships are involved in one casuality.

Loss of human beings by these casualties, in 1865—

	698
Ships in which lives were lost	164
Number of laden ships to which casualties suffered	124
" in ballast	33
" of ships entirely lost	131
" partially damaged	33
Lives lost in foundered ships	275
" by collisions	53
Washed overboard	35
In ships stranded, or cast ashore	335
Vessels over 100 years old wrecked	1
" between 90 & 100 " "	1
" " 80 90 " "	5
" " 70 80 " "	9
" " 60 70 " "	20
" " 50 60 " "	51
" " 40 50 " "	84
" " 30 40 " "	145

The conclusions thus arrived at are that the largest proportion of the wrecks and consequent loss of life are owing to the rottoness of the vesels through age.

During the year there were rescued from watery graves by life-boats, rocket apparatus, &c., 4,162 persons. The number of life-boats in the United Kingdom now amounts to 192.

Miscellaneous.

Vivisection in France.

The following account from the London *Veterinian* is almost too horrible to be believed, did we not get the facts from so reliable a source:—

"In a building or shed open to the air on one side lay six or seven living horses, fixed by every possible mechanical contrivance by the head and feet to pillars, to prevent their struggling, and upon each horse were six or seven pupils employed in performing different surgical operations. The sight was truly horrible. The operations had begun early in the forenoon, it was nearly three o'clock when we entered the place, so that the poor wretches, as may be supposed, had ceased being able to make any violent struggles. But the deep heaving of the still panting chest, and the horrible look of the eyes, when such were remaining in the head, whilst the head was lashed to a pillar, were harrowing beyond endurance. The students had begun their day's work in the least vital parts of the animal; the trunks were there, but they had lost their tails, ears, and hoofs, and the operators were now engaged in performing the more important operations as tying up arteries, trepanning the cranium, cutting down the more sensitive parts, on purpose, we are told, that they might see the retraction of certain muscles by pinching and irritating the various nerves. One animal had one side of his head completely dissected, and the students were engaged in laying open and cauterizing the hock of the same side when we entered."

Non-inflammable Clothes.

"Former attempts in this direction were made with different mineral salts, such as sulphate, phosphate, and muriate of ammonia, liquid quartz, or waterglass, all of which accomplish the object in view, as long as they really permeate the fibre of cloth. But being of a crystalline nature they soon become brittle, and the ordinary wear of clothes, ironing, etc., breaks the miniature crystals in the fibres to dust, which leaves the fabric in its original inflammable condition as soon as it is lost.

A substance not possessing these disadvantages is the tungstate of the alkalis—soda, potash, and ammonia—especially of the former, which has been used for a number of years past at the laundry of the court of Great Britain This salt is of a smooth, fatty, tallowy appearance, does not break off in the process of ironing or in ordinary use, and envelopes the fibre completely, to exclude the air necessary for combustion.

The proper strength of a solution of this salt for the purpose in question is one containing 20 per cent. of the salt. This solution has to be prepared fresh for each application, as otherwise bi-tungstate is formed, which is not very soluble but crystallizes out of the solution, leaving the latter too diluted for application. But this evil may be remedied by the simple addition of a small quantity of phosphoric acid or phosphate of soda. This salt need not be added in greater quantities than 3 per cent. of the amount of the tungstate solution.

As the old country abounds in tungsten ores, especially wolfram, which is a tungstate of iron and manganese, and which is largely imported to this country, the tungstate of soda may be prepared here easily and cheaply."—*Joseph Hirsh.*

Mistaken Pride.

The following very sensible article is from the New York *Sun*. It will not be difficult to judge how far it is applicable to Canada, not only as to the false pride indulged in, but to the very serious defect in our public school systems, in not furnishing any department of education having a special view to preparing boys for following any of the mechanical or other industrial pursuits:—

"Mr. Webb, the eminent ship-builder, gives it as his opinion that one of the reasons for the decline in American ship-building is the difficulty of inducing boys to apprentice themselves to the business and learn it thoroughly. There is a want of skilled and educated laborers in this department of industry, simply because boys prefer to spend their time in some occupation they deem more respectable than manual labor. This is an error that does not apply to ship-building alone. In almost every branch of industry there is a distaste in the mind of the American boy for anything like manual work. There is an ambition, altogether false and very prejudicial to the boy's future success, to escape all rudimentary work and occupy at once a position where a living can be made in the easiest and most respectable manner. This is contrary to all democratic teaching as to the dignity of labor, but it is, unfortunately, true. Young men in this country are ashamed of toil. They are even ashamed of the toil of their fathers before them. They forget how large a proportion of men in all countries have attained wealth and eminence through the avenues of manual labor. Men who have thus risen are often anxious that their own sons shall be brought up to some profession in which it is hoped they will attain more rapid distinction. It seems to be forgotten that skill and intellect will tell just as surely in many other ways as they will in law or any of the professions. There are triumphs to be gained in the material world, and this country, above all others, presents a broad and promising field for the exercise of mind in the subjugation of nature to man's dominion and use. This field is full of honor and profit, but it must be reached by toil, and those who would explore it successfully must begin at the foundation by making themselves personally familiar with the manual labor they expect ultimately to control. The renown of England's great engineers will outlive that of many of her distinguished politicians and statesmen; and the greatest of her engineers were once mechanics in the humblest sense. In America it is specially true that talent will show itself wherever it may be, and men will pay it willing homage. Why then, are young men ashamed to step on the lower rungs of a ladder that reaches so high? It is because parents and others give them false and foolish notions of the superior respectability of callings in which they may spend ten years without gaining a single idea or enlarging their education one iota. Some petty clerkship is preferred to honest, manly, ennobling toil, though it dwarfs mind and body, and yields not half the profit. Our public schools should, in a measure, prepare boys for the practical occupations of life. The College of the City of New York should have departments solely for education in the branches pertaining to mechanical pursuits, embracing the application of the sciences to every-day affairs, and their profitable employment in the various handicrafts of life."

A Niagara Falls Glacier.

"The London *Engineer*, in the course of a discussion of the fervent heat with which the elements composing the interior of the globe are supposed to be kept in a continual state of fusion, introduces the following story, which has been going the rounds of the French papers, all of which seemed to absorb it with edifying credulity as worthy the careful attention of scientific men:—not far from the Falls of Niagara was a glacier, belonging to a company who realized enormous profits from the sale of ice in the western cities during the summer months. A few days later than the Aspinwall explosion, aurora boreâlis of magnificent proportions was observed wheeling its shafts several nights in succession in the northern sky, causing two lightning conductors on the top of the glacier (!) to emit long electrical flames of a bluish colour. In the meantime a boiling noise was heard inside the glacier, accompanied with a disengagement of gas and occasional loud detonations. A captain of militia ventured to enter an opening in the ice with a light, when the glacier burst with an explosion that shook the whole country. Happily nobody was killed except the unfortunate captain, of whom not a trace could be found. The glacier contained 16,000 tons of ice, and after the explosion there was a fall of lukewarm water over a space of 500 yards in diameter. The theory of the cause of the explosion is that the two lightning conductors on the glacier acted under the influence of the electricity as the two poles of a voltaic battery, and decomposed the ice into a mixture of oxygen and hydrogen gases, which of course exploded with resistless power on the introduction of a light.

The above is about as amusing a yarn as the following, which we cut out of the *Norfolk News*, of the city of Norwich, England, just after the Blondin feats of crossing the Niagara, witnessed by so many thousands of our citizens.—[ED. JOURNAL]:—

The alleged rope dancing at Niagara.

A citizen of Niagara in a letter to the *New York Times* of the 30th ult., exposes what he calls the "great Blondin humbug." He says he feels compelled to "speak out in meeting," and the upshot of his revelation is, "that for aught he knows there is no such person in the world, or at least in Niagara, as Mr. Blondin at all; that he has never crossed the falls on a tight rope, or a slack-rope, or any rope at all but the string of a very long bow; and that as the people of Niagara, Rochester, and the western railways of New York have already perhaps made money enough out of their 'jest's prosperity,' it is time that the thing should be put a stop to. Since the immortal 'Moon hoax,'" he continues, "there has been nothing so successful in the way of a vast quiz as the rope-walking invention of a bright Niagara bar-keeper, with its echoes from Rochester and other places along our line of country. As I have not been away from home during the whole summer, I am a tolerably credible witness; and I must therefore assure you that the whole of this wonderful series of stories has grown up out of a bet made by a person in this town that he could bring more people to Niagara in two weeks than the Falls had ever brought here in as many months. How the rope-dancing dodge occurred to him I don't know, but he settled Blondin as the name of his hero, because there was a Blondin once in this country with the Ravels, a very good rope-dancer, now retired and living somewhere in the country of Savoy, who could not of course hear of the story in time to contradict it. Anything funnier or more foolish than the faces of the crowds which have succeeded each other down about the Falls on each successive day announced for the 'feats' you never saw, and the hotels have reaped a golden harvest. But you will observe that not a single individual has ventured in any of the letters to say that he saw Blondin do any of these things. Our local editors and others, of course, enjoying the joke, have joined in it, and a very good joke it has been certainly; but it seems to me it ought to be regarded now as played out. The good people of our town have had their fun out of you, you must admit, and have made a snug thing of it too in a pecuniary way. But a joke, as I said before, has its bounds.—R. E. P."

Recent experiments by the London Pneumatic Co. show that 120 tons of goods can be sent through 18 miles of tubes every hour, by means of atmospheric pressure, at a cost of about a penny a mile.

America has 90,000 miles of telegraph; Europe 60,000; India 3,000.