THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

DECEMBER, 1866.

AMERICAN vs. ENGLISH GUNS.

In these days of advanced scientific and general progress, when the light of Christianity and the universal brotherhood of man ought to be sufficiently potent to prevent conflict and bloody strife amongst the various civilized nations and peoples, greater efforts than ever are being put forth to bring to perfection instruments for warfare and human destruction. Each of the *great* powers of the earth, aye, and some of the *lesser* powers also, are straining their every nerve to secure the latest improvements in armor-plated steam-ships and monitors, rifled breech-loading and steel cannon, steel and chilled-iron projectiles, repeating and breech-loading rifles, &c., &c.; and in many respects great results have been attained —what the end will be, and whether these facilities in the art of prosecuting war will tend to render *war* less frequent, and sooner ended when entered upon, is a matter for thoughtful consideration.

The improvements in cannon, both as to rapidity of fire, and the weight and penetrating force of projectiles, originated the idea of armor-plating ships, which, carried into practice, has created a rivalry between these two forces of assault and defence that is producing tremendous and fearful results.

A wide spread impression exists that American ordnance is much more powerful and efficient than British ordnance; and to dispel the groundless apprehensions of a large portion of the British public, the London *Engineer*, under the heading adopted for this article, effectually settles this question, and shows that the wonderful 20-in. calibre gun so much vaunted by American writers, is admitted by the best informed to be as yet but an experimental gun, and that there is not a line of reliable evidence to prove that those immense charges of powder have ever been fired within 20-in. guns, behind projectiles of adequate weight; and that "there is hardly any evidence whatever in existence regarding these guns, for the very evident reason that, practically speaking, there are no such guns to collect information about."

The only gun that really comes into competition with the best English ordnance, is the 15-in. bore Rodman gun, and this the *Engineer* says is much inferior to the 12-ton broadside gun of the British Navy, or the new 9-in. calibre gun with which the British Navy is now being supplied, either as to rapidity of fire or penetrating power of projectile.

A masonry target, faced with a rolled iron plate 4-in. in thickness, was recently constructed at Fortress Monroe, upon which was brought to bear 15-in. Rodman smooth-bore and 12-in. rifled guns, at a range of only 350 yards; and yet, says the *Engineer*, "It is especially noteworthy that both the 15-in. gun and the Dyer rifled gun not only failed to penetrate the target as a whole, but actually failed to penetrate a 4-in. plate even when the backing only consisted of sand." Yet Major Palliser, in England, with a 9-in. gun and but 43lb. of powder, drove a shot right through a target of 8-in. solid plate, with a backing of 18-in. of teak and an inner skin of iron. Although "The American guns failed absolutely to pierce the 4-in. plate, yet it is as certain as anything can be that it is impossible to back a 4-in. plate with any known material arranged in any known way, so that a hardened projectile fired from the 9-in. English gun at short range will not penetrate it." Again, says the *Engineer*, "We know that a plate 4 times stronger than the American plate has been pierced by them; and the experiments proved that even 14 feet of masonry were unable to prevent the complete penetration of shot fired with but 36lbs. of English powder; and it is certainly not too much to assume on such data that a 4-in. plate backed up with 6 feet only of masonry, would be penetrated at every round by English guns firing hardened pointed projectiles with full charges. It required eleven rounds to complete the destruction of the American target—we fancy the same task would have been more thoroughly accomplished by Major Palliser with half the number." Not only does this writer believe that the English 9-in. is more powerful than the 15-in. American guns, but that it is "the most wonderful weapon in the world." He argues, however, that "it would be folly to attempt to maintain that it will retain this supremacy for any lengthened period," and therefore advocates that now, in time of peace, England should try her hands at 15-in. guns, that their construction may not be forced upon her in time of war. America is doing her best to successfully produce the 20-in. gun, Krupp is about to send a 15-in. cast steel gun to the Paris Exhibition, and England is now manufacturing some half-dozen 600 pounders wrought-iron guns at Woolwich. "It will not be satisfactory that England, the very home of iron and coal, the birth-place of Vulcan, should suffer herself to be beaten in such a race."

We pray that it may be long 'ere Britain is called upon to use the guns in bloody-strife with those of her own language and race, or with any other race of civilized humanity; but come when it may, if it does come, we do not fear that she will be found in this respect behind her rivals.

Since writing the above, we notice that a 15 in. Rodman American gun, with shot and everything complete, has been ordered by the British Government; so that a trial between it and the British gun will no doubt soon be made. We notice also the following interesting description of the Shoeburyness experiments in the *Scientific American*:—

"As the facts come to hand, it is apparent that the power of the nine-inch gun at Shoeburyness, on 20th Sept., was due mainly to the character of the projectile, and not to the gun nor the charge of powder. The Palliser shot and shell are made of chilled iron, which has been pretty satisfactorily proved to be superior in penetrating qualities to either wrought iron, ordinary cast iron, or steel. Both steel and chilled shots were used in these experiments, but while the hardened-steel shots failed to penetrate through the target, and either broke in pieces, or were compressed and bulged out of shape, every one of the chilled-iron shots did effective service, never in one instance changing in form.

The target used was about forty feet long by eight feet high, built of a single thickness of rolled wrought iron, eight inches through, bolted by the Palliser screws to a backing of eighteen inches of teak timber and an inner plate of three-quarters of an inch iron. The whole was sustained by heavy timber backs. The face of the target was not in one plane, but half of its length was inclined at an angle of thirty degrees to the other half, the line of fire being the same in both cases; so that a shot against the inclined face would make, with the target, an angle of sixty degrees. The gun was a nine-inch muzzle-loading rifle, with increasing twist of thread, throwing shot of 250 pounds with charges of forty-three pounds of powder. The distance fired was 200 yards.

The steel shot were cylinders having either pointed heads, struck on a circle the diameter of the shot, flat heads, or the Belgian or ogee head. All of them were hardened in prussiate of potash and oil, or water. Some of them were solid, others, shells with the head screwed into the body, or the base secured in the same manner. Out of twenty-four shots twelve were of this character. Not one of them passed through the target, and every one was either broken into fragments or bulged out of shape.

The Palliser chilled shots in every case penetrated the iron plate, and in one instance, on the square face of the target, went entirely through plate, backing, and lining, and lodged in a pile of iron plating, brick, and stone masonry, twelve feet in the rear of the target. In no instance was the form of the shot changed. The Palliser shots and shells have heads formed on a radius of one-and-a-half diameters of the cylindrical portion. Whenever the Palliser shots struck the inclined face of the target they penetrated, while the cast-steel shots sometimes glanced off.

One circumstance in this trial is remarkable. The steel shots were so hot after striking the target that they could not be handled, while the chilled shots were barely warm. This, with the fact of the change of form in the steel projectiles, proves that much of the energy of the shot had been expended in this direction instead of in penetration.

While the velocity of the shots fired in our Fortress Monroe experiments exceeded in no instance 1,155 feet per second, that of those in this Shoeburyness trial ranged from 1,260 to 1,340 per second."

CITY ABATTOIRS.

We commend to the earnest consideration of our Municipal representatives and Health Officers, the following description of a new Abattoir for the city of New York, as given in the *Scientific American*. The storage and slaughtering of animals in the City of Toronto, and our other Canadian cities and towns, is a great evil, not only as effecting the comfort of their inhabitants, but in the positive danger to public health. In this city these slaughter-houses exist in the midst of dense populations, in unsuitable premises, without sufficient yard room, drainage, or other proper safeguards. Provision should be made for their entire exclusion from the city limits, or at least the populated portions of the city, before another summer:—

The weekly supply of live stock that finds its way from the States of Indiana, Ohio, and other States of the West, to the New York markets, exceeds 6,000 cattle. The slaughter houses for preparing this supply for market, by order of the Board of Health, have been removed during the past season to the environs of the city, yet here they have been a constant source of annoyance, and the community must welcome any plan by which this seemingly necessary evil can be dispensed with.

On Wednesday, the 17th inst., we were present at the formal opening of the Abattoir of the New Jersey Stock Yard and Market Co., located in the village of Communipaw, on New York Bay.

Although a new project in this country, such establishments have long been known in Europe. Paris, of all cities, is best provided with these sanitary institutions, yet the pioneer enterprise of this country equals in capacity the six abattoirs of that city combined.

The systematic division of labor, the use of mechanical appliances to supersede manual labor, and the utilization of what has hitherto been considered refuse matter, are advantages which are attained in this immense establishment, and which must exert an influence that will be appreciated by the public, in lowering the present high rates for all animal food.

The buildings of this company are in direct railroad communication with the whole country, and stock can be immediately transferred from the cars to the pens, where it is examined, bought, and sold. The two principal buildings situated at right angles with each other, are known respectively as the storage and slaughter houses—the former being 540 by 100 feet, three stories in height; the latter 360 by 90 feet, and two stories high.

One of the leading features of the establishment is the humane care taken of the animals previous to slaughtering. The feverish state in which they are taken from the cars is allayed by time, and a plentiful supply of food and water, and the evil effects of meat killed in this diseased state are thus overcome. The care taken, also, to thoroughly warm and ventilate the buildings, is an outlay to the company that will benefit the public health.

The store house has pens sufficient to easily contain 45,000 sheep and hogs, the neat cattle being stalled in other buildings. The slaughter house has hanging room for 6,000 hogs. The process of killing and dressing is speedy and efficacious. On the lower floor 1,200 cattle daily can be readily prepared for market, and even this number can be doubled if occasion demanded, affording a supply sufficient for the New York markets for three and a-half days. The hogs are driven up to the second story, struck on the head with a sledge hammer, thrown into a vat of boiling water, the bristles thoroughly removed, cleaned, and swung off on portable gambrels, in the short space of seven minutes each. The time occupied in dispatching neat cattle is nearly twenty minutes per head. Sheep are handled at the rate of 3,000 daily. Means are employed for condensing the poisonous vapors, and preserving the purity of the surrounding atmosphere. A capacious ice house at the end of the slaughter house will keep the meat fresh during the summer months. We heartily congratulate the much-abused citizens of this city upon the prospect of getting rid of the driving and slaughtering of animals within city limits, a very barbarous custom which has too long prevailed.

CANADIAN MANUFACTURES FOR THE PARIS EXHIBITION OF 1867.

We recently had occasion to visit several leading establishments in various parts of Upper Canada, to select or obtain articles for the Paris Exhibition. From Gananoque to Galt, we found all classes of manufacturers, whether in metals, wood, leather, wool or flax, so fully engaged in filling orders that scarcely any special efforts could be secured for the preparation of articles to represent us on this occasion—the most that the Board will succeed in realizing, to any extent, are selections from manufactures such as are made up for stock, or on current orders. Perhaps it is best that it is so. What we desire to show in Paris, is, the exact position we have attained, and the progress the Province has made in the industrial arts, since we exhibited there in 1855, and again in London in 1862. Articles got up for these exhibitions, should be in such materials, workmanship and style, as are best adapted to the wants of the Province, and the particular uses for which they are intended; or such articles as are adapted for exportation, got up in such materials as are abundant in the Province, and in such styles and elaborateness of manufacture as will enable us to realize a good profit, at prices that will ensure them a ready sale in foreign markets. But even this latter consideration is but of secondary importance, while our entire manufacturing capacity is fully employed in supplying our local wants—it is only in consideration of the future home demand not coming up to our capabilities in this respect, that it is desirable to make any special efforts in this direction.

In the village of Gananoque we were pleased to find the agricultural hand tool manufactory of D. F. Jones; the machine and bolt and nut factory of E. E. Abbott; the carriage springs and pump factory of J. Briggs; the carriage axle and hinges and rivet manufactory of Byers and Mathews; the cut and pressed nail works of Cowan & Britton; and the hame works of Mr. Skinner, all in full operation, with abundant orders to fill. In the Kingston Penitentiary, the malleable hardware and locksmith's works of Mr. W. C. Evans; the boot and shoe factory of Mr. Offord; and the cabinet works of Mr. Drennan, were fully engaged in filling orders. In Oshawa, the same may be said of the agricultural tool manufactory of Whiting & Co., and the furniture works of E. Miall & Co.—the latter manufacturing largely good cheap furniture for exportation to Europe. In St. Catharines we found a new building nearly completed for Mr. Flints saw factory—the old one having been destroyed by fire last autumn. The demand for his saws, from the 66 in. to the 6 in. diameter circular, and various other kinds, being much larger than he can supply.

In Hamilton, the sewing machine manufactory of R. M. Wanzer & Co., the boot and shoe factory of Nisbett & Co., as well as almost every other branch of business there, are fully engaged with orders. We found the same to be the case with the edge tool factory of H. H. Date, of Galt; the flax and rope works of Elliott, Hunt & Co., of Preston; the woollen mills of Mr. Hespeler and the knitting factory of Messrs. Randall and Farr, of Hespeler. We could not but be gratified at the extent and substantial character, and the completeness of the machinery, of the three last mentioned establishments. The Ancaster Knitting Co. we also found fully engaged with orders. We also visited the Streetsville Flax Works, of Messrs. Gooderham & Perine, of which a full notice was published in the August number of the Journal. These mills seem to be fully employed in the manufacture of seamless bags and coarse articles of linen. The extensive woollen mills of Messrs. Barber, at Streetsville, also noticed in a previous volume of the Journal, are in full operation, with a demand for their manufactures fully equal to their ability to satisfy.

The same may be said of almost all our Toronto mechanics and manufacturers; so that although our selections of articles for Paris will be very good, a credit to the Province, yet they will not have been prepared specially for the purpose—our manufac ures will be shown as they are to be found here at any time; and not as we are able to produce them, if we could devote the time and labour necessary to their production.

All goods intended for exhibition should be sent to the Secretary of the Board of Arts and Manufactures by the 1st of December, instant; as shipments will have to be made immediately after that date.

A full list of the articles sent will be published in the January number of the Journal.

GRAND PLOUGHING MATCH.

According to promise in our last issue, we notice briefly the grand Ploughing Match held on the 31st of October, near this city.

Owing to the difficulties usually attending the conducting of ploughing matches during the days of the Provincial Exhibition, the Agricultural Association abandoned the idea and, instead, gave substantial aid and encouragement to the Directors of the city of Toronto Electoral Division Society, in a match got up by them and open to the whole Province. The contest came off on the date above mentioned, in a field adjoining the Davenport station of the Northern Railway, about five miles from the city. The prize list comprised both money and useful implements and other articles, amounting in value to nearly $1,000, divided into five classes and fifty-nine prizes, from $1 to $150 in value, as follows:—

First class—open to all.

Second class—open to all, who had not taken a 1st or 2nd prize in either 1st or 2nd classes at any previous match, within the past five years.

Third class—Cast-iron Beam Plough—open to all.

Fourth class—For boys under 18 years of age. No one was allowed to compete in this class, who had taken a 1st prize, in any former match; but all such might compete in any of the former classes.

Fifth class—For boys who had never competed in any former match.

At 11.15. a.m., forty-three ploughs started, all but three completing their task within the time allowed. The work done was excellent, and above the general average. Great interest was manifested in the Boys classes, in both of which the work done was very commendable, and encouraging for the future.

In the evening a coversazione was held in the St. Lawrence Hall, for the distribution of the prizes. About 300 persons were present, who partook of refreshments supplied by Mr. Webb.

After refreshments the President, P. Armstrong Esq., took the chair, and briefly addressed the meeting. R. L. Denison, Esq., next addressed the company, and presented the prize cards in the first class. The Rev. W. F. Clarke, Editor of the *Canada Farmer*, delivered lengthy and interesting remarks, and presented the prize cards in the second class. Professor Buckland presented the prize cards to the successful competitors in the third class, prefacing the presentation with appropriate remarks. The prize cards in the fourth and fifth classes were presented by James Fleming, Esq., and Mr. Alderman Strachan. Dr. Ross of Toronto, and Mr. Stewart of Chicago, also addressed the meeting.

This entertainment was of a novel and pleasing character, and was enlivened during the evening with music by the excellent Band of the gallant 10th Royal Volunteers.

For prizes awarded and donations given, see advertisment on fourth page of cover.

EXIT FROM PUBLIC BUILDINGS.

On three several occasions, in the pages of this Journal, we have urged upon our Architects, the general public, and the Legislature, the desirability of making provision for the opening outwards of all exit doors of Churches, and other public buildings; especially having in view the many melancholy instances of loss of life occurring from the reverse practice.

We are pleased to notice that our Legislature, at its late and probably last session, passed an Act (29, 30 Vict. cap. 22) making it imperative that all such buildings in future to be erected, shall have their exit doors and gates of outer fences so constructed; and that all trustees or managers of such public buildings already erected, shall have their doors and gates so altered as to open outwards, within *twelve* months from the passing of the Act, which was passed and assented to on the 15th of August, 1866—so that all parties concerned should bear in mind to have the necessary alterations completed before the same date in the year 1867, under a penalty, in case of failure to comply with the provisions of the Act, of *Fifty Dollars*, and a further fine of *Five Dollars* for every week succeeding in which the necessary changes are not made.

The duty of seeing that the provisions of the Act are enforced in Cities, Towns, and Incorporated Villages, is devolved on the High Bailiff, Chief Constable, or Chief of Police, under a penalty not exceeding *Fifty Dollars* for neglecting to perform such duties.

CLOSE OF THE SIXTH VOLUME.

The present Number closes the Sixth Volume of the Journal. We regret the limited income of the Board does not permit the securing of more diversified talent, in the production of Original Articles for its pages. We can, however, refer with satisfaction to the large amount of varied and valuable information it contains, as selected from the best British and other Mechanical and Scientific Journals.

The *Institute*, a London publication, in noticing the Journal, says,—"Its original articles and selections being mostly of a practical character, are not calculated to please the masses; but thinking men—men who take an interest in the world's industrial and scientific progress, will find its pages largely occupied with selections from the best European and American Scientific and Mechanical periodicals, and with much information on leading practical topics of Canadian interest."

Besides some twenty Original Articles, of a more or less interesting nature, this volume embraces a considerable number of Lectures and Papers on a variety of Scientific and useful subjects; some eighty useful Receipts; seventy Tables and other valuable practical memoranda; sixty Statistical Tables and memoranda; lists of Trade Marks registered, Patents of Inventions issued, and British and American Books recently published; one hundred articles or notices of Mechanical Inventions or processes; a variety of selections on Photography, and its more recent manipulations; one hundred and fifty Selections of an interesting Miscellaneous character; Notices of Proceedings of Mechanics' Institutes; Prize Lists, Awards, and description of the Arts and Manufactures Department of the U. C. Provincial Exhibition; and other useful information—certainly furnishing a full equivalent for the trifling subscription charged.

It is a cause of regret, that so few of those engaged in the important Mechanical and Manufacturing operations of the Province, ever think of committing their thoughts and experiences to paper for the benefit of others. The pages of this Journal furnish a medium for such interchange of thought, which we hope will be made available during the ensuing year.

We shall be happy to continue our acquaintance with present subscribers, and to make many new acquaintances, also, with new subscribers to the seventh volume.

The Journal is not published for profit, but at a considerable loss; the object of the Board being simply to furnish useful and valuable practical information, at such a small cost that no one need be without it.

Board of Arts and Manufactures
FOR UPPER CANADA.

ANNUAL MEETING OF THE BOARD.

The Annual Meeting of the Board for reception of the Report of the retiring Committee, and election of office-bearers for the ensuing year, should be held on the first Tuesday of the next month (January); but as that will be New Year's Day, the meeting will no doubt adjourn to the third Tuesday of the month, of which due notice will be given by circular.

We append some provisions of the act relating to the electing and certifying of Delegates to the Board.

The *ex-officio* members are the Minister of Agriculture, Professors of Physical Science in Colleges and Universities, the Principal Officers of the Provincial Geological Survey, Chief Superintendant of Education, and Presidents of all Incorporated Boards of Trade and Mechanics' Institutes of Upper Canada.

(Provisions of the Act.)

The Board of Trade in each City and Town in Upper Canada, shall, at its last regular meeting in each and every year, elect and accredit to the Board of Arts and Manufacturers for Upper Canada, one of its body as a member thereof.

Each incorporated Mechanics' Institute in Upper and Lower Canada, and each incorporated Society of Working Men, respectively, shall, at its last meeting in every year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada respectively (according as its place of meeting is in Upper or Lower Canada) one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and having paid a subscription of at least one dollar each to its funds for the year then last past; and every Art Association may elect one delegate for every twenty members on its roll, who have paid a subscription of not less than four dollars each to its funds.

The names of the Delegates so elected shall be forthwith transmitted by the Secretary of the Board, Society, Association or Institute electing them, to the Secretary of the Board to which they are elected, who shall thereupon inscribe their names upon the Roll of the Members of the said Board, for the year then about to commence; with the names of the Delegates when transmitted by the Secretary of a Mechanics' Institute, Society, or Association, there shall be transmitted a statement verified by the oath of the Secretary transmitting the same, to be taken before a Justice of the Peace, of the names of all the members on the roll of such Mechanics' Institute, &c., &c.

ANNUAL EXAMINATIONS.

The Board will hold the usual Examination of Members of Mechanics' Institutes, in the month of May next—the exact time of which will be stated in the January number of the Journal. We have not space in the present number for the full programme, but in the meantime we give the list of subjects of study:

1.
- I. Arithmetic.
- II. Book-keeping.
- III. English Grammar and Analysis.
- IV. Geography.
- V. Penmanship.

2.
- VI. Algebra.
- VII. Geometry.
- VIII. Principles of Mechanics.
- IX. Geometrical and Decorative Drawing and Modelling.
- X. History.

3.
- XI. Trigonometry.
- XII. Measuration.
- XIII. Practical Mechanics.
- XIV. Conic Sections.
- XV. Chemistry & Experimental Philosophy.
- XVI. Geology and Mineralogy.

4.
- XVII. Animal Physiology and Zoology.
- XVIII. Botany.
- XIX. Agriculture and Horticulture.
- XX. Political and Social Economy.

5.
- XXI. English Literature.
- XXII. French.
- XXIII. German.
- XXIV. Music
- XXV. Ornamental and Landscape Drawing.

TRADE MARKS.

Trade marks registered in the office of the Board of Registration and Statistics, and open for inspection at the Library of this Board.

(*Continued from page* 290.)

T. W. Georgen, Barrie. "Georgen's G. G. G. Real Reliever." Vol. A, folio 144, No. 539. Dated October 18th, 1866.

F. Marais Ottawa. "English Cleansing Fluid of F. Marais." Vol. A, folio 147, No. 555. Dated October 22nd, 1866.

Wimming, Hill & Harrison Ware, Montreal. "John Bull Bitters." Vol. A, folio 145, No. 561. Dated October 26th, 1866.

W. Thos. Atkinson, Oshawa. "Atkinson's Aromatic Fluid Magnesia." Vol. A, folio 146, No. —. Dated October 30th, 1866.

Messrs. Gates & Co., Toronto. "Victoria Sewing Machine." Vol. A, folio 147, No. 595. Dated November 12th, 1866.

Selected Articles.

THE USE OF FUEL—BITUMINOUS COAL.

In our last issue* we published a few practical suggestions in relation to the management of fires of anthracite coal. We made the general statement that mineral coal was a condensed form of carbon requiring a large amount of oxygen to produce perfect combustion.

Bituminous coal contains more of the resinous qualities of the vegetable matter from which all coal is derived, than anthracite. It is largely used for the production of illuminating gas, and, where it is employed for heating purposes, supersedes in some measure, the use of other artificial lights in dwellings. In our own experience we have read, many an evening, by the light of a generously large grate filled with glowing coal. When a lump was placed upon the fire, for a time a volume of dense black smoke would rush up the chimney, until the heart of the block was warmed by the persistency of the fiery mass below, when it would crack open, sometimes with a report, and send up blue and then bright yellow flames, illuminating the whole room. One thing was noticeable, and that was, that when such a fire was first kindled it would give out no appreciable heat. The energy of the fire seemed to be directed to overcoming the resistance of the fuel. The blue, gaseous flame was somewhat like the popular idea of the moon's light, without heat, yet this blue flame was a highly combustible gas, if it could have been retained long enough in contact with the heat to have mixed with sufficient oxygen. Its value as a fuel was lost by being forced up the chimney to the outer atmosphere.

In the burning of bituminous coal in open fires there should be first a proper grate. Almost all the grates used for this purpose, in dwellings and other buildings, for warming purposes, are too coarse. They allow the finer particles of coal to pass through and get lost in the ashes; or, these particles induce another fire below the grate and tend to melt it down rapidly. When bituminous coal is used in large lumps. much of its valuable carbon is wasted in the form of gas or black smoke, before it can be ignited and give out any heat. The coal should be fine enough to be easily heated and ignited. The sooner this is done the quicker is the fire, and the more the carbon of the coal is utilized. For this reason a finer grate than is generally used, and smaller coal than that commonly placed upon the fire, is an economical method of utilizing the greater portion of the carbon. The grates now in use can be readily changed to effect this saving by placing a sheet of iron, closely perforated with small holes, upon the inside of the grate bars. We have tried this plan with excellent results.

These remarks are not of universal application; for there are several varieties of bituminous coal, some so nearly approaching pure bitumen as to melt in mass and cake, refusing to be separated permanently until well coked. This sort would require a more open grate or an admixture of coke to make it burn freely. Coke is the residue of bi-

* See this Journal page 298.

tuminous coals, from which the volatile portions have been driven off, in the form of gas, by heat. It is measureably pure carbon, and of so porous a structure as to readily admit the passage of the atmospheric air through the mass.

The philosophy of blowing a fire is simply forcing a larger relative amount of oxygen into connection with the carbon than the ordinary draft would furnish. It acts, also, in a mechanical way, by driving off the products of combustion, the principal of which, carbonic acid gas, is as inimical to a clear fire as to animal life.

The proper management of a fire then, consists in furnishing oxygen in quantities sufficient to burn all the carbon. A good draft is necessary, and the coal should be fed upon the fire in small quantities. If a dense, black smoke is the result of replenishing the fire, some of the most valuable parts of the carbon are carried, unconsumed, up the chimney and entirely lost. The fire should be kept always bright, and it will, to a great extent, consume its own gases before they can escape. As in anthracite, so in bituminous coal, the remains of the fire are valuable. The unconsumed coal is more or less coked and will more readily ignite than the green coal. None of this should be wasted. * * * * *

It should always be remembered that the pure white or yellow flame is that which yields the heat. Dark smoke and blue gases are not the results sought for in burning fuel.—*Scientific American.*

HEALTH REPORT, CITY OF TORONTO, 1866.

We offer no apology for occupying space in the Journal with the Report of the Local Board of Health for this city, including the very valuable Report of Dr. Tempest, one of the Medical Health Officers to the Board. If there are, as Dr. Tempest says, strong reasons for believing that the cholera will visit us "in earnest next warm weather, and perhaps this winter to some extent," we cannot do better than to urge upon the citizens of this and other Canadian towns, the desirability of continuing, with even increased diligence, the sanitary precautions so laudably inaugurated, and, judging from this Report on the health of the city, with such encouraging success.

Sanitary Laws are but little understood by the general public, or even by our Municipal authorities; we therefore deem it our duty to place on record, in the pages of this Journal, any valuable papers or documents coming under our notice tending to show the extreme importance of these laws—especially to the working classes, whose physical and moral well-being, and even life itself, depend so much on their observance:—

Board of Health Report.

In the early part of the present year, the question of the public health of the city, in view, especially, of the expected advent of cholera, attracted a good deal of attention. At a meeting of medical men, called at that time, amongst other suggestions and recommendations, was one for the appointing of a Medical Health Officer for the city. The Health By-law, No. 431, passed 27th April last, empowers the Council, on the recommendation of the Board of Health, to make such appointment; but while your Board hesitated to recommend that step, the proclamation of the Governor-General was issued, declaring to be in force, the Act 22 Vic., cap. 38, Con. Stat. Can., respecting the preservation of the public health; and the regulations of the Central Board of Health, required the appointment of such Medical Health Officer in all towns and cities having 8,000 of a population. The proclamation was issued on the 4th of May, to continue in force for six months or longer, as might be directed by the same authority. Acting under such authority the Local Board appointed Drs. Tempest and Rowell to be Medical Health Officers, and the duties of the office were at once commenced. The amount appropriated by the Council for the purposes of the Board was $5,000, which amount could not be expected to be final, as the estimate presented on the 9th July, asked for $5,865, exclusive of the sum required for street-cleaning, making drains and culverts, &c., which was estimated at $2,000, of which the Board have spent only $372 21, and under the item of medicines and food for the poor, hospital fees, and for destroying clothing, the expenditure was but $69 70. A good deal of economy has been practised, and the only item in which the expenditure exceeds the estimate is that of scow-building and service, where the estimate of $1,000 will be exceeded by $66 30. It should be borne in mind, however, that the scows are in the best of order, and valued at $522. The total expenditure of your Board already disbursed amounts to $5,084, and a further appropriation of $2,000 is required to carry on the winter operations that are urgently called for. Your Board further beg to report that the services of the Medical Health Officers, east and west, as well as the Health Inspector east, so far as the Board is concerned, ceased on the 6th instant.

N. Dickey, *Chairman.*

Board Room, Nov. 17th, 1866.

DR. TEMPEST'S REPORT TO THE LOCAL BOARD OF HEALTH.

Appointed by you on the 12th May, to be Medical Health Officer for the city, and subsequently my duties under your orders being confined chiefly to the eastern half of the city, your Board has been, from time to time, furnished with such statements as the exigencies of the time required. But in now submitting a final report, it will be well to generalize and to indicate what is required in the future, rather than to go over former details. At that time it was conceded on all hands that the city needed a great deal of cleansing, public and private, but the machinery employed for such purpose was very imperfect.

Street and Lane Cleaning.

The Board of Health had just commenced a system of scavenging by means of carts, seven in number, one for each ward, the material which they collected being taken to the foot of Caroline street from the east half of the city, and from thence by scows to the goal farm on the Don, where it was unloaded by the prisoners, and used to manure the land, the property of the city. Shortly after my appointment to this office, the Board of Health appointed a colleague for the western half of the city, who took charge of that portion of the duty required for such locality. Scavenger carts were a novelty, and experience in working them was required before the advantages and defects of the plan could be ascertained. A great deal of trouble was met with in getting men for this work who would faithfully perform their duty. The work is not very attractive, but if the Medical Health Officer had the employment and dismissal of the men, the direct control would afford a beneficial change, and by employing carts as wanted, and then only, a great saving might be made. Scavenger carts are needed to some extent even in winter, but in the summer months the removal of garbage is imperative. Under directions from the Local Board, and the health of the city being good, no carts are now employed; but at the return of spring an immense amount of decomposible stuff will have to be removed, or we shall have a return to thedays of old.

A schedule of the work done by each of the three carts in my department has been kept since the 8th of August, and the pay list made out accordingly. The quantity of surface filth removed from the east half of the city was 3,300 loads of a one-horse cart, taken by the scows in 22 trips. Of this quantity a portion, possibly one-third, has been brought to the slip by private parties, and the whole of it is valuable for manure. A considerable quantity was removed from some of the streets, for instance, Victoria, Stanley, Adelaide, Nelson, Toronto, Court and other streets, as well as from many lanes, and in some cases men were employed to gather the refuse in heaps and assist in loading the carts. In former years, the garbage thrown on the street, appears to have been allowed to decompose until all was mud together, and a biennial cleaning of a few of the more public streets, was the only attempt at removal. Notwithstanding the large quantities taken up this year, and the cautions issued by the Board of Health, the habit of making use of street and lane as a deposit for house refuse of every kind is so established in this city that inhabitants of even respectable houses, or at any rate, their servants, regularly violate the by-law in this respect, often selecting the vicinity of their neighbour's back gate as a specially eligible spot. But even where people attempt to obey the by-law. and place their house offal in a box or barrel whence the scavenger can remove it, a street Arab in want of fuel, eyes covetously the wooden vessel, and in the early morn, its contents emptied, the thing has vanished.

The Scows.

Two excellent scows have been built by the Board for their use to carry scavenger matter from the slips on the Esplanade to the place of deposit. They are in good order, and are believed to be worth all they have cost. As the weather now and during the winter does not permit of these being used, they have been carefully laid by at the Gaol Farm on the Don.

Winter Operations.

During the fall and winter scavenger matter does not require such speedy removal, decomposition is slow or is altogether arrested; still, when from there being no depth of snow street garbage is visible, it should be gathered and removed at once, and not left to accumulate until spring. It is recommended that, during the winter, the scavenger matter should be removed from the east half of the city by waggons and sleighs. The cost of removal, after being taken to a place of deposit near Caroline street, would be nominal only; its value for manure being such as to nearly pay for drawing it away. Ultimately it is hoped that it may more than pay for its cost of removal. An important part of winter operations is the emptying of cesspools. Many hundreds of these require attention this winter. During the hot weather, by arranging a system of permits, all unnecessary meddling with offensive matters was prevented, and when removal was absolutely required they were deodorized. But, during the cold weather, when these operations could be conducted without much offence or injury to the public health, private parties, not being annoyed by any obvious nuisance, are apt to allow these affairs to remain neglected to the subsequent injury of themselves and others.

Regulations of the Central Board.

The regulations of the Central Board had all the force of law during the past half year, and the Medical Officers were charged with their execution. Had all the operations within the scope of the regulations been carried out to the full extent, the expenditure for some single items would have exceeded the whole amount expended. The spirit of the regulations has been observed more than the letter, especially in regard to the 4th clause, concerning offensive trades. All slaughter houses, chandleries, and places for the collecting and storing of animal remains, have been repeatedly visited, and caution and advice given for the partial, if not total removal of bad smells; and in general the advice has been well received and attended to. In a few cases it has been necessary to bring parties before the Police Magistrate. While hesitating to enforce the law by removing all offensive trades from the city, unless the invasion of cholera should render that step imperative, parties have been informed that they must be prepared to suspend operations when required, and in the meantime attend to the requirements of the Medical Officer in respect to the mode of conducting operations.

Drains and Sewers.

A very large proportion of the drains, and the culverts from gratings to main sewers, are untrapped, and give exit to noxious gases from the elongated cesspools under ground. Instead of trapping them at a vast expense, a system of disinfecting and deodorizing has been tried, and has succeeded to a great extent. A solution of sulphate of iron in water was used for the first few months of summer. A quantity was poured down every grating and into every pond hole in the city whence noxious effluvia were found to arise. Latterly, a solution of per-chloride of iron has been used. A quantity of this equal to the disinfection of 150,000 gallons of the worst sewage has been put into the sewers during the last six weeks. The benefit derived from this process in keeping down the horrid smell of drains from the streets and basements of houses, has been quite apparent; and not less so in the improvement of the quality of the water in the bay. Similar solutions have been used to disinfect bad and offensive localities, places where dangerous diseases were present, such as cholera, cholera morbus, and allied disorders. A cart with puncheon and horse and man were employed over the whole city, and especially in localities where more urgently needed from the presence of disease or noxious emanation. This has proved a most judicious proceeding. The sewerage system of the city is very incomplete and imperfect, the fall of the sewers running east and west is too little for the ready discharge of their contents, and when flushed by a heavy rainfall or thunder shower, they cause back water and regurgitation of their gaseous contents upon the service drains and cellars of certain localities. At such times happy are they who have neither cellar nor drain. Witness the effects of the thunder storm of July 17th last, when half the cellars of King street were flooded, not with rain water and street washings, but in many cases with something worse from the sewers. In many places also, parties over a large district continue to drain into the beds of what were once little streams, tending usually in a south-easterly direction. Many of these are now dry, and the mere sewage they carry constitutes a great nuisance. The remedy may be sought in empowering the Medical Health Officer to advise with the City Engineer and the Board of Works in respect to constructing and localizing drains and sewers.

The situation of Toronto is a moderately good one for drainage, and its sanitary condition might vie with and even surpass that of almost any town or village in Canada; but the system obstinately persisted in, of emptying into the bay all the filth of the city, public and private, must be put a stop to, or else our water supply must be obtained from some other quarter.

Utilization of Sewage.

In view of the condition of the sewers on level streets, and perhaps also on economic grounds, the question of the utilization of the sewage is not unworthy of consideration, as the formation of drains to houses and water closets proceeds, and as the city increases in density of population, the quantity of valuable matter worse than wasted on the present plan will be augmented.

Intercepting Sewers.

To relieve the drainage sewers of some of the level streets, and to obviate the necessity that will otherwise ultimately arise from the enlargement of many main sewers, intercepting sewers might be made at a lower level and of a greater capacity. One or two such running diagonally south-east might be made to discharge into a reservoir. The disinfectant now used being applied, will throw to the bottom the valuable portion as a sediment, which can be removed as it is formed, by the action of a hollow screw, and then carted away for manure; while the clear and comparatively pure water can be pumped into the bay without manifest injury to it as a source of water supply. The reservoir need not cause the slightest nuisance or be at all offensive. There is no good reason why sewage in any of its stages should give offence or cause injury to human beings. Chemistry furnishes us the means of suppressing all its detrimental and offensive properties, and retaining all that are useful.

An Abattoir or Central Slaughter-House.

Whatever view may be taken of the practicability or propriety of the proposition made above, there can be no good reason why thousands of animals should be annually slaughtered in the city, and the filthy products of the operation allowed to poison the ground and the air, or else discharged into the underground channels to find their way into the water we drink.

An abattoir or central slaughter-house should be built in some suitable locality, and no killing allowed elsewhere. The meat would be better, for large animals need not be fevered by baiting and driving through the crowded streets, nor the smaller ones kept lying in waggons or on the ground for hours in the hot summer's sun: an unnecessary cruelty for which man is punished in the vitiated meat he eats, and the disease thereby engendered. New York is now jubilant over a splendid structure of the kind, and not only are benefits expected in a sanitary point of view, but it is asserted that animal food will be supplied much cheaper. Were such a structure erected near the out-skirts of the city, arrangements could be made for the removal of offal, without any contamination of the soil, air, or water of the city.

Condition of the Bay Water.

One source of contamination of our water is the discharge of refuse distillery and brewery slop into the Bay. The Bay water increases in temperature with the arrival of warm weather, and when it reaches a certain point, and the water has little current, fermentation takes place and decomposition ensues. The proprietors of the large establishments at the east end of the city have carried out, this season, the desires of the Medical Health Officer in regard to disinfecting their slop. Cow stable drainage should not be carried to the Bay. Cattle are fed on distillery slop in large numbers, and last spring the manure emptied into the Bay, from this source, could be measured by the furlong. Such a course should not be continued. In every case, on either large or small scale, the discharges from domestic animals ought to be removed from the city by the owners, at their own expense.

The surface water of the streets, after rain-falls, must have been less charged this year than formerly with decomposing matter, from the fact of the removal, by the carts, of so much garbage and scavenger matter from the streets and lanes.

The Bay water this season is said by the employees of the Water Works to be clearer and to show less obvious impurity than during any previous season. But after every rain shower, and especially after such a freshet as that of the 17th July last, the large quantities of street washings and sewage carried down visibly affect the water. At such times the flushing of the sewers thus affected, carries to the source of water supply not only *mud*, composed of finely-powdered sand, clay, and decomposed organic matters, no longer subject to decay; but also organic matter, animal and vegetable, from street and sewer, undergoing decomposition, reaches the Bay, the average temperature of which, during the summer months, being over 60° F., allows that process to go on, and a considerable amount of objectionable matter, in a form to cause or aggravate disease, enters the Water Works at such times. During the steady mild weather, after the Exhibition week in September, the Bay water improved; an examination, on the 17th of October, of the water inside the Works, showed that it contained no objectionable quality, but of samples taken before and since, the same could not be said.

The Water supplied to the City.

The character of water supplied is very variable. The water, in passing through the pipes, may deposit much of its undissolved contents, and these may in future time be taken up and carried to the place of supply by water that was unobjectionable when it entered the Works. The mud and cat-fish drawn by the steam fire-engine from the hydrant at the corner of King and Yonge streets, may have astonished the uninitiated, but it is certain that all the mud was not got out on that occasion. But if the water, as drawn into the Works, were unobjectionable in character, this difficulty would be constantly lessening. At present there is no filtering of the water, the supply-pipe runs out from the Esplanade a long way, but, as it is broken in several places, one within 150 feet of the Esplanade, that may be assumed to be the spot from which the water is obtained.

A better locality would be a little west of the point of the Island, opposite the Queen's Wharf. A filtering crib placed there and connected with the works by an iron pipe with joints (such as is used in some Scottish water works), to allow it to accommodate itself to the varying depth of the water, would remedy all the difficulty. At no time this summer has the water of the locality indicated presented any unfavorable character. In the mean time, a filtering crib should be constructed at the place of the present source, so as to prevent floating particles and mud from being sent into the pipes. The softness of the water of Lake Ontario makes it peculiarly eligible for culinary and domestic purposes. Containing only about 8.44 grains per imperial gallon, equivalent to a little more than 1 grain of inorganic matter in 10,000 grains only, the water of the great lakes is remarkably pure. Economically considered, soft water is better than hard, as in the preparation of tea, coffee, and liquid food, hard water is wasteful. In this view alone, therefore, it is desirable that the public water supply should be so extended as to furnish all the more densely populated districts of the city with lake water. But if we take into account the character of the water found in many of the wells in crowded places, and to which the pipes of the water works are not laid down, the strongest reasons can be given for an extension of the works.

The quantity of Water Supplied.

The quantity of water supplied by the Water Works averages more than one and a half millions of gallons daily (1,662,171). This quantity is pumped by two engines, one, the old one of thirty horse power, supplying the Yorkville Reservoir, with more than half a million of gallons per day of twelve hours working, and usually working eight days per week. This reservoir is about 125 feet above the level of the lake. The new engine of sixty horse power is used to fill the St. George's Reservoir, seventy feet above the level of the lake, sending to it more than one million gallons daily, or six and a half million gallons weekly, in six working days of twelve hours each. The capacity of each reservoir is about three million gallons, together containing only four days' supply for the city, irrespective of any sudden and great demand that might occur on account of fire. But this small store need not cause apprehension, while we have the unbounded supply from the lake and the Works are in good order. A connection formed between the pipes forming the system of each engine and reservoir, allows the water of one system to be distributed by the pipes of the other, but the larger, or new engine, cannot be used to drive the water to the Yorkville Reservoir, from the smallness of the pipes leading to it. The quantity of water used at even a large fire is insignificant compared with the daily wants of the city. The Yorkville Reservoir was only drawn on for one-sixth its capacity at the Rossin House fire, while the ordinary Sunday expenditure will reduce it twice that amount. The lavish use of the water of the Works is quite apparent, for while 20 gallons per head per day is the common allowance in English towns for every use, public and private, the quantity furnished to this city equals thirty gallons per head per day, while only a moiety of the inhabitants make use of it. Much of it must be allowed to run to waste.

A constant water supply is of great consequence in a sanitary point of view, as well as on account of its necessity in case of fire. If the service supply be not constant, the public filtering of water is insufficient, for the vessels in which consumers store it become the depots of impurities. The service supply of this city should be so remodelled that the water should be always on, both in dwellings and at the hydrants, and when it is found that waste is allowed the supply should be by metre.

An extension of the supply to certain districts is urgently needed, and the wells of those parts should be closed, for many of them derive their contents from the soakage of foul and even a fæcal soil.

Health of the City.

The health of the city this season will compare favourably with any of the last few years. Although great fears were entertained of a sickly season, especially in view of the approach of cholera, thanks to a kind Providence, and to those hygienic measures, public and private, which have been adopted, we have been spared hitherto. The mortality for the six months ending September 30th, is less by 159, and, deducting the deaths of volunteers, by 168, than that of 1865—the mortality of which year, was slightly lower than that of 1864. The death rate of 1865 was about 22·2 per 1,000 per annum. The death rate of 1866 will be about 19 per 1,000 per annum. A death rate of even 16 per 1,000 is too high for a city placed as Toronto is, with cheap and abundant good water for the taking, and excellent opportunity for drainage. A death rate of 14 per 1,000 would be a natural one, and the public should not rest satisfied until that point is reached. The diminished mortality this season is chiefly in diseases caused or aggravated by filth. The whole gain for six months being 168, the gain in zymotic or preventible diseases is 115, and if a careful scrutiny were made in those cases where the cause of death is imperfectly recorded, this number would be larger.

Ozone, the principle to which the atmosphere owes much of its chemical activity, has rarely been quite absent from the air of this city. At the residence of the writer, during the present season, the fluctuations have been considerable, but only from the 12th to the 16th of September have the indications been very low for more than one day consecutively. On the days specified, the tests showed no higher than from zero to 2° on the scale of 12.

Cholera.

The cholera was brought into our city on at least five occasions. The vigilance of the employees of the Board of Health was fully exercised to prevent its spread, without causing any panic by public announcement. But no great wave of the dread pestilence reached us; only the drops betokening the nearness of the storm. Many times, oftener than we know, did the contagion come about us: families fled hither from infected cities, having lost some members ere they came, and the victims of the plague were brought here for interment, in the baggage cars of a railway amid the trunks and baggage of passengers. A clause of the Health by-law as prepared last spring, was struck out by the Council in its wisdom, and Toronto allows every man to do what is right in his own eyes. The Health Officers have no power to prevent the introduction of dead bodies from contagious disease.

Will the cholera come in earnest, either this winter or next summer? is frequently asked. In all human probability it will come next warm weather and perhaps this winter to some extent. There are so many places just now in America where the disease is lurking, and the re-importation of it from abroad is so frequent, that it is too much to presume we shall escape altogether; but undoubtedly a perseverance in the wise precautionary measures adopted here and in many other places; *and especially the continued vigilance of railway and steamboat* authorities and *officials to the disinfecting of privies and urinals*, will do much to prevent the introduction of the disease. In case it does come the Health Officers should be at once notified. The highest authorities have declared that the greatest crime a man can commit is to conceal the existence of cholera. Considering that the advance of medical science in the *prevention* of disease, has of late years far out-stripped that of its treatment, and that we possess the power of almost, if not altogether, arresting the spread of cholera, it appears incredible that concealment should be practiced. Yet the last season in New York, private physicians were found only to report their fatal cases, and them only because it was necessary to procure burial permits; here, unlike other cities in the civilized world, no burial permit is necessary, nor even a certificate of the cause of death.

Small Pox.

Small pox prevails in this city at present in several places. There is no provision for public vaccination of the poor, no compulsion in respect to the operation, nor any means of preventing the disease being carried out by those afflicted with it. Many deaths have occurred lately, and many families afflicted with it are in a state of destitution. Some of them have been attended to and relieved by your officers, and some are now under care. The present state of things, with regard to small-pox and its prevention, are no credit to the city. We are half a century behind the age. Were we in England, the number of deaths from preventible diseases, even this year, would obtain a reproof from the General Board of Health, a call for a statement of the localities where the deaths had occurred, and a demand for improvement. In some countries it is considered that the life of every person should be guarded by the State; here, human life is more cheaply held; poisonous disease mows down its hundreds, and a mysterious Providence is blamed,

All which is respectfully submitted,

W. Tempest,
Medical Health Officer, East.

158 SCHEDULE A., appended to Dr. Tempest's Report.

TABLE OF INTERMENTS *in the City of Toronto, in 1865 and 1866 respectively, for the Six Months from April to September inclusive, as drawn from the Burial Registers.*

Year	St. James' Cemetery. (Zymotic.)	St. Michael's Cemetery. (Zymotic.)	Necropolis. (Zymotic.)	Total Deaths from Zymotic or Preventible Diseases.	Deaths from other causes.	Grand Total.
1865.	81	55	124	260	427	687
1866.	37	29	79	145	383	528

Zymotic deaths in 1865	260
" 1866	145
Diminution in 1866	115

Deaths from other than Zymotic causes, 1865 ...	427
" 1866 ...	383
Diminution in 1866	44

Diminished mortality of 1866—

Zymotic diseases........................	115
Other causes	44
	159

Machinery and Manufactures.

"Case-Hardening."

Case hardening is the superficial conversion of iron into steel, and combining the hardness of the latter with the toughness and cheapness of the former. Iron is tenacious and ductile, but by case-hardening it has this same tenacious body with an exterior coating of steel, produced by the action of heat on animal carbons, shrunk, as it were, over its surface, compressing the iron body, thereby producing a greater strength. It is not for economy alone that articles of iron are case-hardened. They are stronger and more durable than if made wholly of steel.

The most common articles of case-hardening that are met with are the locks, mountings, etc., of guns and rifles. To make the lock-plates and hammers of steel would be attended with many disadvantages as well as an advanced cost, not only the price of steel over that of iron, but the difficulty of working requiring more care and more experienced workmanship. If these parts were made of steel they would require to be hardened, and, as steel can only be hardened throughout its entire thickness, there would be great risk of breakage from accidental blows and changes of atmosphere. But being made of iron and case hardened, it has the tenacity of the iron and hardness of tempered steel; the steel surface extending to a greater or less depth according to the time it remains in the hardening material.

Cast-iron is as easily case-hardened as wrought-iron, and drill-chucks or face-plates thus treated are rendered of as much utility as if made of tempered steel, and at scarcely one-tenth the cost. Malleable iron has also the same properties of case-hardening that wrought-iron has, and the greater portion of gun and rifle trimmings are thus made and case-hardened.

Prussiate of potash answers a very good purpose for superficial case-hardening, but it produces only a thin film or skin or hardened surface. Any animal charcoal will answer. Burnt horns, hoofs, bones, etc., will make animal charcoal. Scraps of leather, old boots and shoes, burned in a pan in the common forge fire and reduced to a powder with a hammer, are a ready means for producing this carbon. Ground bone-dust as it comes from the agricultural stores is the most ready as well as the cleanest form of material. The bone or ivory dust does not need burning. The articles to be hardened are put in iron boxes and the bone-dust well packed around them. Care should be taken that the articles do not touch each other. The box must be tightly closed, luted with clay, inserted in the fire, and brought gently to a red heat. If the articles are large they require more time than if they were small or thin. After the box becomes hot, it will require to remain from half an hour to two or three hours, the mechanic exercising his own judgment as to time in the size of the articles. When properly heated, draw from the fire and quickly empty the contents into a bucket of cold water, taking care that the work comes to the air as little as possible.

A very good substitute for iron-boxes are short pieces of gas-pipe, with a plug screwed into one end and the other end covered with an iron cap and luted so as to be air-tight. When the articles can be conveniently packed in pieces of pipe they are preferable to iron boxes for the reason that they are more readily turned in the fire and are more easy to handle. After the work is hardened, if it is required to polish it, proceed the same as with iron or steel. When the work is polished or burnished before it is case-hardened it will, after the operation is completed, present a variety of mottled tints that are pleasing to the eye. Many prefer the work left in this condition, as it will not rust so readily as if polished.

If a portion of an article is to be kept in a soft state and the remaining part to be case-hardened, the portion to be left soft can be covered with a thick coat of moist clay, so as to prevent the material in which it is packed from coming in contact with it. If there is thought to be danger of small articles cracking by the immersion of them in the water, a film of oil poured on the water, which must not be too cold, will prevent a too sudden contraction of the metal and the articles will not crack.—*American Artizan.*

The Acid Test of Iron.

Although there can be no doubt but that the only way of obtaining accurate information respecting the strength of any particular kind of iron or steel is to subject it to directly applied strain, yet there are many circumstances under which such a test cannot be conveniently carried out, and where any test which does not require special machinery would be extremely useful. One rough test of this kind which is frequently used, is that of breaking a sample of the material and judging of its quality by the fracture; and another, which is not so generally known or employed, is the "acid test," which is carried out by subjecting samples to the action of dilute nitric or sulphuric acid, and noticing the result, This acid test is particularly applicable when it is desired to ascertain the capabilities of the material for resisting wear, as, for instance, in the case of railway tires, and we know of at least one railway company by whom the test is used for this purpose with advantage. Thin slices are cut from the tires to be tested, and the surfaces polished, and these samples are then placed in dilute nitric acid for about twelve or fourteen hours. At the end of that time it is found that the structural formation of the tires is very clearly developed, the manner in which the piles were built up being plainly shown in the case of the iron tire, while in the case of those of steel the surface presents a more or less honeycombed appearance, according to the fineness of the grain of the material. We have known samples of Krupp's steel tires only exhibit a frosted appearance on the surface after a whole night's submersion in the dilute acid, whilst some slices of iron tires 3-16 inch thick submitted to precisely the same test, were eaten completely through in some places. Speaking generally, it may be said that the power of resisting wear varies very much in the same proportion as the power of resisting the action of the acid, and the latter also shows clearly whether the material is of the same texture throughout, and whether it may therefore be expected to wear equally.

At the meeting of the British Association held at Bath, in 1864, attention was directed by Mr. Sorby to a refinement of the acid test; this consisted in the application of microscopic photography to the corroded surface. Mr. Sorby exhibited a series of photographs, taken by Mr. Hoole, of Sheffield, from various samples of iron and steel which had had their surfaces polished and then acted upon by dilute acid in the manner we have described. The photographs were taken direct from the microscope, and were largely magnified. In the meteoric iron the crystaline nature of the material was clearly exhibited, and in the gray pig crystals of graphitic carbon were shown shooting through the mottled surface of the metal, while in refined cast-iron long lines of hard parts were to be seen arranged in layers. Slightly-hammered bloom showed a confused mixture of iron and slag; Bowling bar-iron, a compact texture, the slag being driven off; and Swedish iron a still closer grain, more resembling steel. The different steels also presented entirely different appearances, the difference between blister and cast-steel being strongly marked. Altogether, it appears that the acid test is an extremely useful one, particularly when assisted by microscopic examination, while the system of taking magnified photographs, as suggested by Mr. Sorby, affords an excellent means of registering the results obtained.—*Mechanics Magazine.*

Separating Phosphorus from Metals.

It is well known that phosphorus is a substance which prevents the production of pure qualities of iron and other metals, and all attempts to remove the same have hitherto failed. Mr. Carl H. L. Wintzer, of Hanover, has found that chlorine gas and chloride of calcium are adapted to obtain the desired result. Chlorine gas, as a simple element, does not decompose, and chloride of calcium is the only combination thereof which, at the different degrees of temperature which occur in practical metallurgy, neither volatilizes nor decomposes unless another agent be introduced. Other known combinations of chlorine, as chloride of magnesium decompose even at the boiling point of water; chloride of sodium becomes volatile at a comparatively low temperature.

Mr. Wintzer therefore employs chlorine gas and chloride of calcium for the removal of phosphorus, in processes of melting ores and in the treatment of metallurgical products. He makes use of this gas and the salt in blast furnaces, as well as in the process of puddling, refining, and recasting, and in any kind of furnace and in all processes of melting, applying the gas direct or adding the prepared salt (chloride of calcium) in any convenient form; or employing solutions containing muriatic acid, with the simultaneous use of lime or calcareous substances, by which process chloride of calcium is formed at the moment of its application. Through the effect of chlorine gas and chloride of calcium on phosphatic ores and metals, volatile combinations of phosphorus are formed and thereby the phosphorus is removed. The process is as follows:—In smelting an ore of iron or other metal containing phosphorus as an impurity, the operator charges into the smelting furnace with the ore, chloride of calcium in the proportion of from five to twenty-five parts by weight for each part of phosphorus found by analysis to be contained in the ore, and in other respects the smelting operation is conducted in the ordinary manner. The resulting metal will be found much more free from phosphorus than if the ore had been smelted without the addition of chloride of calcium. In place of adding the chloride of calcium direct, lime and muriatic acid may be mixed separately with the ore, or may be otherwise applied in combination. It is more convenient, however, to employ chloride of calcium ready formed. Or, in place of employing chloride of calcium, chlorine gas may be used; the gas may be mixed with air and forced as a blast through the ignited charge in the furnace, or the gas itself may be blown through the melted metal after it is tapped out of the furnace. The quantity of chlorine thus applied should be from three to fifteen times the weight of the phosphorus contained in the ore or metal. Chloride of calcium or chlorine may be applied in a similiar manner when remelting iron or other metals, when it is desired to separate phosphorus therefrom. Phosphorus can thus be separated from all metals to which a strong red heat can conveniently be applied; more especially, however, is it more applicable to the treatment of iron and copper.—*Mechanics' Magazine.*

Punched Tubes and Gun Barrels.

The manufacture of punched steel tubes and gun-barrels by Messrs. Deakin & Johnson's process, is likely to become a most important industry. The principal gun-barrel makers of Birmingham are now advertising that they are prepared to make fifteen thousand of these gun barrels weekly, and Messers. John Brown & Co., of Sheffield, have nearly completed the erection of very heavy machinery for rolling the tubes, after punching, into barrels and jackets, for 7-inch rifled cannon. It is but a short time since even the most enterprising steel masters believed it to be impossible to punch a 10-inch hole down through an ingot two feet six inches in diameter and four feet high; yet this has already been accomplished, while, as for gun barrels, a single tube, of dimensions sufficient for the manufacture of four regulation barrels, is punched almost at a blow. The material employed is Bessemer steel, and it is indeed a question whether any other steel would permit of this mode of manufacture. With the least imperfection of the ingot, it cracks open or flies to peices under the punch, and thus only perfect material can pass. As to the endurance of barrels made by this process, one test made at Birmingham, some time since, showed that a barrel of the Enfield pattern, punched from Bessemer steel, withstood, without injury, single charges of sixteen drams of powder and twenty-five Enfield bullets. The latter were forced into a continuous bar of solid lead when fired yet the bore of the barrel remained intact.

The best gun barrels are now made of Marshall's iron, which is sold in skelps about 8 inches long, 5½ wide, and ⅜-inch thick, at, we believe £28 per ton. Bored and ground and with the "lump" forged on, these barrels go into the gun trade at a cost of about 10s. 6d. each. Yet from "greys," "reins," or other faults, from sixty to seventy, and sometimes two hundred out of every thousand, are rejected at proof. With the new punched steel barrels, which are at least one-half better than iron, and which can be profitably made at the same price, there are no defects whatever in the metal, since no defective ingot will withstand the punch. Messrs. Deakin & Johnson's process is equally adapted to the manufacture of hollow steel shafts for marine engines, railway axles, etc. A hollow axle thus punched and rolled, and 5½ inches in external diameter, has been tested upon three-feet supports, by a weight of 19 cwt. falling 25 feet, the blows beginning, however, with a 5-foot fall, rising progressively 5 feet at each blow. Under the highest fall, the axle was finally deflected 7½ inches, but no sign of fracture was shown.—*Engineering.*

Prizes for Breech-loaders and Cartridges.

To stimulate inventors and manufacturers the British Government has offered a reward of £1,000 for the best and £600 for the second-best breechloading fire-arm, and £400 for the best cartridge. These rewards refer only to non-repeating arms; for repeating rifles, a further reward of £300 is to be given for the best of its class. The Government has issued a set of conditions for the guidance of those who may desire to compete, from which we learn that the non-repeating rifle is not to weigh more than 9 lbs. 5 oz. without the bayonet, and to measure 51 inches long. Sixty rounds of the ammunition when made up are not to exceed 6 lbs. 4oz. in weight, and the cartridges must carry their own ignition. It is stipulated generally that the arm as a whole must be as little liable to injury by long-continued firing, rough usage, and exposure as the naval rifles converted to breech-loaders on the Snider system. They are also to be as capable of being used without accident by imperfectly trained men, and of being manufactured in quantities and of uniform quality. The Boxer cartridge is taken as a standard for the new ammunition, which must be as little liable to injury by rough usage, damp and exposure in all climates as is that cartridge as made for the Snider-Enfield rifle. It must also be as little liable to accidental explosion, and as capable of being manufactured in large quantities. A finished specimen of the arm, as well as drawings, particulars of cost, and twenty rounds of ammunition, are to be sent to the War Office before the 30th of March, 1867. Such arms as are supplied will be tried, and a selection made of the most promising. Six of each of the selected arms and a thousand rounds of ball cartridge per arm are then to be supplied, for which the Government will pay £300 to each selected competitor. With these rifles the final trial will take place, and upon their performances the rewards are to depend. The Secretary of State intimates that he will take care that no ingenious novelty shall be adopted into the service without proper acknowledgment. An additional stimulus to invention is given in the promise that, if the rifle to which the first prize is awarded is adopted into the service, it shall bear the inventor's name. With regard to magazine and repeating arms it is stated that they are not to be less in length than 48 inches, including the stock. The limit of weight for these arms is fixed at 9½ lbs., exclusive of charges in the magazine. Such of these arms as are accepted for further trial will be paid for at the rate of £60 each, inclusive of one thousand rounds of ammunition per arm.—*Mechanics' Magazine.*

Itinerant Bell-founders.

Within less than a century since there still existed in England a race of itinerant bell-founders. They were mostly found in the southwestern counties, though we believe also in the fen country and on the northeastern side of England. These men were reputed as gipsies. The rings of bells in several of the rural churches of Somerset and Devon were cast by these wild workmen. The writer's own father recollected traditions, the particulars of which, even to pointing out the site of the temporary bell foundery were, in his early life, handed down in his native parish in the north of Devon, respecting a ring of six church bells thus cast. There were three men, an older and two younger bell-founders, who went about with their families and tools in gipsy style. When they had bargained to cast a set of bells, they went about the country buying up old copper and pewter, chiefly old vessels and household stuff, much of which they got from Bristol; and though apparently poor, money for such purposes seemed always forthcoming from unknown hoards. Having collected sufficient material in the case here referred to, the men and their families returned to the parish, and at the side of a high-banked Devon ditch, upon a small "moor" or bit of dry common land, established themselves. They built their own air-furnace from *adobes*, or sun-dried bricks of the loam on the spot, and made their loam molds of the same. The only roofed building was a "lining," as a lean to-roof is called in Devon, of a few feet square, thatched with furze and straw to keep the molds from a chance shower, and this was all burnt to light and dry the furnace. When the great day came for casting the bells, all the little parish was in commotion, and collected to see the operation; and much entreaty was made by the artists for silver coin" to improve the metal;" and some, it was said, was actually thrown into the furnace mouth by the hands of the rustic donors, who had a shrewd suspicion that otherwise it would reach the pockets of the founders only. The six bells were cast, and with perfect success, and the writer has still in his ears their sweet though coppery tone, as mellowed by distance they sounded on summer evenings in years gone by. These bells are small, the largest probably not more than six or eight cwt., but they are in perfect tune; and to produce even such a peal, with such appliances, would not be readily undertaken nor instantly done now by the best workmen in the great establishments of our Warners or Meyers. There are probably scores of rural parishes in England the bells of which were made in the same way as were those. With these wandering bell-casters one can scarcely doubt that there must have become extinct many means and methods resulting from that inventive mother necessity of great ingenuity, simplicity, and value.—*Practical Mechanic's Jour.*

Hydraulic Power.—The Great Brooklyn Organ.

The new organ just put up in Rev. Henry Ward Beecher's church in Brooklyn, N. Y., by the builders, Messrs. Hook, of Boston, is the largest ever built in this country. Its bellows is driven by hydraulic power. The machinery of the motor is simple, and can hardly be put out of order; the motive power is derived from the reservoir on which the Brooklynites depend for water, and will be absolutely reliable, though, in case either machinery or water give out, it can also be worked by hand. The water is governed by a crank at the side of the organist, who has before him a water-gauge and four bellows' indicators. The hydraulic engines in the cellar are four in number, consisting each of an upright cylinder, into which the water is admitted by a double-acting valve, which throws the jet alternately above and below the piston. The pressure of the Ridgewood water is about 45 pounds to the square inch; and the piston is of 6 inches diameter, and has a 12-inch stroke. The air is thus pumped up into the bellows on the ground floor, and its supply is regulated by the same contrivance which graduates the hight of water in a steam boiler. When the organist is using the full range of the instrument, the levers connecting the bellows with the working-valves below are depressed and let in the full power of water; and as the quantity of wind decreases, the levers proportionately regulate the rapidity of the piston-stroke by closing out the water. So that it is thoroughly automatic, and effective throughout the whole compass of power. This apparatus is used in the organ of Plymouth church for the first time in the United States. It is the invention of an English organ-builder named Cox, and has been patented in this country. Messrs. Hook have purchased the patent.—*American Artizan.*

Steel Rails.

Steel has many important advantages over iron beyond that of its superior durability. It is a consideration of much importance that steel rails would not involve more than one-fifth the interruption of the line consequent upon relaying. But it is a very much more valuable property of Bessemer steel that it is secure against breaking. For when we speak of steel rails we assume that they are made under a contract by which any bar, taken at random, must withstand the blow of a weight of one ton falling 25 feet, the rail being laid upon 3 feet supports. Steel rails may be taken up during a hard frost and bent double under a steam hammer without breaking, although steel that would stand this test without cracking would be somewhat softer than would be desireable. The test by a ton weight on a 25 feet fall should be enforced under all contracts for steel rails. Any good steel rail will withstand it perfectly, while an iron rail would be broken with the same weight on a 5 or at most a 10 feet fall. Steel rails, besides their greater durability and tensile strength will bear, as girders, nearly twice the load of iron rails of the same section, as carefully ascertained by Mr. George Berkley, the engineer to the Great Indian Peninsula Railway Company, and who has ordered many thousand tons of steel rails. The greater stifness of the steel rail enables it to distribute the weight upon the wheels of a train over an increased number of sleepers, and thus over an increased surface of ballast. The line, therefore, remains in better condition than when laid with iron rails, and there is far less weakness at the joints. The ends of steel rails, especially when they are not fished, have been fully proved to be at least ten times as durable as the ends of iron rails, being at once stiffer, harder, and tougher. Old steel rails, too, bear at least as high a proportion to their original value as iron rails. It is a fact that steel plates worth £30 per ton in the market are rolled from the crop ends of steel rails, and these, which will pile and weld, are now worth from £7 to £8 per ton, new rails selling at prices varying between £12 and £16. Old steel rails can be melted in a cupola into white iron; they can be reconverted along with new metal in the converter; they can be cut, piled, and welded; or they can be at once heated and be rolled into bar steel and plate steel of good quality. Considering, therefor, that they have no disadvantages as compared with iron rails, unless it be their greater first cost, which is much more than compensated by there far greater durability, it is not remarkable that they are coming into rapid use, nor that the London and North Western Railway Company should have established large and costly works of their own at Crewe, capable of making 360 tons of steel weekly. Sixty-three miles of the company's line were already laid with steel rails at the time of the last half-yearly meeting. The Great Northern Company have decided to lay steel rails through their principal stations and upon all the inclines upon their line; but when we consider that, with the exception of a short length of 1 in 110 near Kingscross, none of their inclines are steeper than 1 in 178, and that they are mostly 1 in 200, we cannot doubt that steel will soon be adopted for the whole line. As for other lines, we may say that at least 1,000 tons of Bessemer rails are made weekly in England and Wales, and probably 400 tons on the continent of Europe. The evidence in favour of steel is now become so clear, and the reasons for its immediate adoption so obvious, that we cannot but think that it is a most mistaken policy for engineers and railway managers to longer postpone the use of steel, whether upon the ground that it will yet become cheaper or otherwise. A generation of iron rails will have worn out before any considerable reduction can be expected in the price of Bessemer steel. One cannot doubt that the time will come when iron rails will be obsolete, just as the old cast-iron tramps and, after them, the fish bellied rail passed out of existance.—*Engineering.*

Purifying Water.

Mr. Bird, of Birmingham, has patented the use of the neutral sulphate of alumina for purifying water. Its action depends upon the presence of carbonate of lime in the water to set free hydrated alumina, and as carbonate of lime is almost universally present, the process is as universally applicable. The advantage of the use of this compound is, that beyond converting carbonate into sulphate of lime it introduces no new salt, while the organic matter is carried down with the hydrated alumina.

Useful Receipts.

Antidote for Poison.

Doctor J. Edmonds, a prominent London physician, writes as follows to the London *Times*:—"I inclose a simple, safe and accessible prescription for the whole range of acid corrosive poisons, which, if promptly used, will almost invariably save life. Mix two ounces of powdered chalk or magnesia, or one ounce of washing soda, with a pint of milk, and swallow it at one draught; then tickle the back of the throat with a feather or finger so as to produce vomiting. Afterward drink freely of milk and water, and repeat the vomiting so as to thoroughly wash out the stomach. Any quantity of chalk or magnesia may be taken with safety, but soda in large quantities is injurious. I may add, that the narcotics are excepted. Milk is an antidote for almost all the poisons, and especially if followed by vomiting."

Recipe for Curing Meat.

To one gallon of water, take 1½ lbs. of salt, ½ lb. of sugar, ½ oz. of saltpeter, ½ oz. of potash. In this ratio the pickle to be increased to any quantity desired. Let these be boiled together until all the dirt from the sugar rises to the top and is skimmed off. Then throw it into a tub to cool, and when cold, pour it over your beef or pork, to remain the usual time, say four or five weeks. The meat must be well covered with pickle, and should not be put down for at least two days after killing, during which time it should be slightly sprinkled with powdered saltpetre, which removes all the surface blood, &c., leaving the meat fresh and clean. Some omit boiling the pickle, and find it to answer well, though the operation of boiling purifies the pickle by throwing off the dirt always to be found in salt and sugar. If this recipe is properly tried, it will never be abandoned. There is none that surpasses it, if any so good.

Gold Varnish for Brass.

This varnish used to be made of various resins colored with curcuma, safflower, or alcanna. All of these colors are not staple enough to make a well-looking, durable coating upon the metal. Better results are obtained by employing an alcoholic solution of bleached, golden-colored shellac, tinged with aniline yellow, which gives a bright-colored, durable varnish that may also be employed for tin.

A Fire-proof Wash for Shingles.

The following simple application will no doubt prove of great value:—A wash composed of lime, salt, and fine sand or wood ashes, put on in the ordinary way of whitewashing, renders the roof fifty per cent. more secure against taking fire from falling cinders or otherwise, in case of fire in the vicinity. It pays the expenses a hundred-fold in its preserving influence against the effects of the weather. The older and more weather-beaten the shingles, the more benefit derived. Such shingles generally become more or less warped, rough, and cracked; the application of the wash, by wetting the upper surface, restores them at once to their original or first form, thereby closing up the space between the shingles; and the lime and sand, by filling up the cracks and pores in the shingle itself, prevent it from warping.—*Mirror & Farmer, Manchester, N. H.*

Fruit Stains.

To remove fruit stains from napkins, &c., let the spotted part of the cloth imbibe a little water without dipping, and hold the part over a lighted common brimstone match at a proper distance. The sulphurous acid gas which is discharged, soon causes the spots to disappear. Or, wet the spot with chlorine water.—*Jour. of App'd Chemistry.*

Copper in Pickles.

To detect copper in pickles, put some of the pickle, cut small, into a vial with 2 or 3 drs. of liquid ammonia, diluted with one-half the quantity of water. Shake the vial; when, if the most minute portion of copper be present, the liquid will assume a fine blue color. Or immerse a polished knife blade; the copper will deposit upon it.—*Ibid.*

Practical Memoranda.

Notes on Steam Boilers.

A small steam-boiler, insulated upon a glass plate, was for some time exhibited at the Polytechnic Institution. Under a pressure of steam, continuous electric flashes were discharged from the boiler.

According to Professor Rankine, Mr. Morris Pollok, of Govan, near Glasgow, introduced air through tubes perforated with small holes, and placed near the bridge of steam-boiler furnaces, as long ago as 1818, or twenty-one years before Mr. C. W. Williams' patent.

Boiler explosions are always reported; but simple ruptures, which often occur from over pressure, and with no further consequences than the loss of steam and local injury to the boiler, are seldom publicly reported, and there are many who are not aware that such casualties ever happen.

In a boiler explosion that occurred at Wharton Colliery, near Chesterfield, in June, 1856, a portion of the boiler weighing 3 cwt. was thrown to a distance of 1,200 feet.

The current testimony of those who have employed fans or blowing engines, for promoting combustion in steam engine furnaces, is, that the forced draft causes a considerable waste of coal.

The boilers of the West India Royal Mail steamships, according to the authority of Mr. Pitcher, of Northfleet, last on an average but six years.

The old notion that the three-legged tea-kettle boiled soonest, was correct, because the legs conducted heat more rapidly than the plane surface.

Boiler flues 6 feet in diameter were occasionally made many years ago. A boiler made in 1838, with 6 feet flues of ¼ inch Lowmoor iron, collapsed twice under a pressure of 10 lbs. per square inch of steam and 3 lbs. of water, equal to 13 lbs. in all.

Many boilers have been made with "conducting pins," which are simple screw-bolts, tapped anywhere through the plates, forming the flue-heating surface, and projecting, say, 1½ inches into the water, and as much more into the flue. These pins conduct additional heat to the water, and thus increase the evaporating power of the boiler. Their use is attended, however, with some obvious disadvantages.

Dry steam has electric properties; when in a gaseous state it is a non-conductor of electricity. The electric discharges which may be obtained from dry steam are supposed to attend the process of condensation.—*London Engineering.*

New Alloy.

M. H. Micolon, of Paris, proposes a new alloy for the manufacture of all metal articles—bells, hammers, anvils, rails, and non-cutting tools. The alloy consists of 20 parts of iron turnings or tin waste, 80 parts of steel, 4 parts of manganese, and 4 parts of borax; but these proportions may be varied. When it is desired to increase the tenacity of the alloy, two or three parts of wolfram are added. When the cupola is ready, the iron and steel are poured in, the manganese and borax, and the vessel is filled up with coke.

Divisibility of Copper.

The divisibility of copper is so great that a grain of it dissolved in an alkali will give a sensible color to 500,000 times its weight in water.

Statistical Information.

UPPER CANADA PROVINCIAL EXHIBITION STATISTICS.

According to promise made in the Nov. No., we give the following Tables of Statistics, being as complete returns as we have been able to obtain:—

Tickets.

	Toronto, 1862.	London, 1865.	Toronto, 1866.
Tickets sold at gates @ 25c...	43,228	45,000	36,944
Tickets to Members	9,260	5,800	4,268
Total	52,488	50,880	41,212

Entries.

	Toronto, 1862.	London, 1865.	Toronto, 1866.
Horses	428	407	376
Cattle	620	533	486
Sheep	633	700	758
Pigs	208	215	185
Poultry	250	333	340
Grains and Seeds	460	792	462
Roots and Field Crops..........	386	554	438
Horticultural Products	1,197	1,282	1,233
Dairy Products, Bacon, &c.....	128	223	145
Agricultural Implem's—power	186	189	128
Agricultural Implem's—hand..	142	188	122
Cattle Food, Manures, &c......	3	18	11
Arts and Manufactures Department......................	1,676	1,690	1,589
	6,317	7,221	6,273

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

ARTICLES.	No. of Entries.	Amount of Prizes offered.	Amount of Prizes awarded.
Cabinet Ware and other Wood Manufactures.	51	$222 00	$ 98 00
Carriages and Sleighs, and parts thereof	66	207 00	157 00
Chemical Manufactures and preparations	34	94 00	69 00
Decorative and Useful Arts, Drawing and Design	74	250 00	183 00
Fine Arts..................	332	771 00	554 00
Groceries & Provisions	45	122 00	95 00
Ladies' Work	284	201 50	217 50
Machinery, Castings, & Tools	108	476 00	326 00
Metal Work (miscellaneous), including Stoves	152	312 00	236 00
Miscellaneous, including Pottery & Indian Work	73	98 00	136 00
Musical Instruments ...	25	153 00	97 00
Natural History	22	98 00	80 00
Paper, Printing, and Book-binding	26	88 00	64 00
Saddle, Engine-hose, Trunk-maker's Work, and Leather	88	238 00	177 00
Shoe and Boot-maker's Work, and Leather...	79	154 00	112 00
Woollen, Flax, and Cotton Goods, Furs, and Wearing Apparel	130	532 00	401 00
Totals, 1866	1,589	$4,016 50	$2,992 50
Totals, 1865	1,690	3,726 50	2,430 00
Totals, 1864	1,517	3,437 50	2,576 00

The following is an abstract of entries and amounts under similar heads in the various Agricultural and Horticultural classes:—

	No. of Entries.	Amount of Prizes offered.	Amount of Prizes awarded.
Horses, of all kinds	376	$1,464 00	$1,341 00
Cattle, " "	486	2,479 00	2,127 00
Sheep, " "	758	773 00	571 00
Pigs, " "	185	504 00	433 00
Poultry	340	231 00	206 00
Grains, Seeds, Roots, &c.	900	831 00	780 00
Horticultural Products.	1,233	729 00	679 00
Dairy Products, &c.....	145	223 00	213 00
Agricultural Implem'ts	250	1,240 00	772 00
Cattle Food, Manures, &c.	11	36 00	24 00
Totals, 1866	4,684	$8,520 00	$7,146 00
Totals, 1865	5,531	9,707 50	8,606 75
Totals, 1864	4,882	9,131 50	8,035 25

Summary.

Totals of all Dep'mts:	No. of Entries.	Amount of Prizes offered.	Amount of Prizes awarded.
1862	6,319	$12,036 50	$10,722 00
1863	4,756	11,866 00	9,166 00
1864	6,399	12,559 50	10,304 25
1865	7,221	13,434 00	11,036 75
1866	6,273	12,536 50	10,138 50
Increase from 1862 to 1866	—	$500 00	—
Decrease do. do.	46	—	$583 50

By the foregoing tables it will be seen that, in the Arts and Manufactures department, the awards are equal to about 74½ per cent. of the amount offered, while in the Agricultural and Horticultural departments they are about 80½ per cent.; and that the amount awarded in the first department is about 28½ per cent. of the whole amount awarded in all the departments.

Hospitals in Canada.

According to Government statistics, the number of hospitals receiving aid from public funds in 1865, was 21; of these there were in Montreal, 6; Quebec, 3; Three Rivers, 2; Kingston, 2; Toronto, 2; Ottawa, 2; Hamilton, 1; London, 1; St. Hyacinthe, 1, and Sorel, 1.

The total assets of all these Institutions, apart from Legislative grants, was $1,145,670; and total liabilities $127,822. Their incomes, from all sources, $145,253; expenditure for the same year, $188,899. Number of patients at the beginning of the year, 1,492; admitted during the year, 8,130; discharged, 6,942; died, 1,110; remaining at the end of the year, 1,570; aggregate number of days the whole were in hospital, 584,416. The aggregate number of days patients were in hospital in 1863, was 553,723, or about 1 in 300 of the population—thus showing a less proportion to have been in hospital in 1865 than in 1863.

The average expense for each patient, per day, exclusive of buildings and repairs, was thus a little over twenty-two and a half cents per day; the number of deaths scarcely one-eighth of those admitted; average time each patient remained in hospital, about sixty days.

Savings Banks in Canada.

There were, in 1865, two Savings Banks in Quebec, one in Montreal, two in Toronto, and one in Cobourg; there are besides these, ten Building Societies with Savings Departments connected—six in Toronto, two in London, and two in Kingston.

Total assets of the Savings Banks in 1863, was $2,711,651; in 1864, $3,049,608; in 1865, $3,216,965. The liabilities were respectively $2,487,590; $2,796,038; and $2,926,466. Total amount of deposits in 1865, was $3,371,293; and in 1863, $3,074,141, The amount withdrawn in 1865, was $3,322,234; and in 1863, $2,828,244. Number of depositors in 1865, 13,274; in 1863, 11,682. In 1865, 9,374 were depositors for amounts under $200; 3,217 between $200 and $800; and 683 above $800 each. The profits in 1865, were $45,700, the expenses $27,419.

The Savings Department of the Building Societies show deposits in 1865, $588,908; of those 987 were for less than $200; 379 between $200 and $400; 277 from $400 to $800; and 185 above that sum.

Taking both kinds of institutions, the whole amount due depositors in 1865, was $3,489,376—the number of depositors being 15,123. The average amount to each depositor was in 1863, $220 76; in 1865, $230 73; the average per head of the population for 1865, $1 17. Rates of interest vary from 4 to 7 per cent.

"Strikes."

In a recent speech Lord Grey said that during the "strike" in the blast furnaces in England the sum of £50,000 in wages was lost, and that among those connected with the rolling mills, who are still on a strike, about £100,000 in wages had already been lost.

Underground Railways.

Underground travelling increases at a surprising rate in London. In the first six months of 1863 the number of passengers carried on the Metropolitan line was 4,823,437; in 1864 for the same period, it was 5,207,335; in 1865, it was 7,462,823, but in the first half of the present year it rose to 10,303,395.

The revenue has correspondingly increased; in the first of the four periods it was £53,058, in the last it amounted to £102,947.

Krupp's Steel Works.

Krupp's great steel works at Essex, England, cover 400 acres of ground, consume 720 tons of coal daily, use the steam of 120 boilers, burn 7000 flames of gas, and give employment to above 8,000 men and boys, whose wages amount to nearly £400,000 a year. The establishment last year turned out upward of 50,000 tons of cast steel, one-third of which was made into guns, the rest into bars, shafts for engines, axles, railway bars, tires of wheels, plates for boilers and ships.

Tobacco.

The total amount of tobacco procured throughout the world is estimated as follows:—Asia, 309,900-000 pounds; Europe, 281,844,500; America, 248-280,500; Africa, 24,300,000; Australia, 714,000; making in all 865,039,000 pounds.

Lead Pencils.

Great quantities of pencils are now made in England of a composition formed of sawdust and small pieces of lead, which are ground to an impalpable powder, mixed with some cohesive medium. In Keswick, 250,000 pencils are made in a week, or 13,000,000 a year, and 12,000 cubic feet of cedar are annually consumed.

Paris Exhibition.

The article "Administration," page 308 of the November Number of the Journal, consists of a portion of the rules of the Commissioners for the Paris Exhibitions of 1867, and should have been so distinguished. Its not appearing in its proper place (page 232), was owing to an oversight of the printer in the final making up of the September Number.

Miscellaneous.

Ventilation—Its Necessity and Neglect.

In referring to this subject we are aware that we risk disgusting our readers by introducing a theme which has become hackneyed and threadbare by incessant repetition in newspapers, books, lectures, and by other means. Still it is none the less important, and that it is habitually ignored by thousands of otherwise sensible people is our excuse for a few practical suggestions.

The last generation paid no attention to this matter, at least in this country. They had no need. Dwellings were sufficiently ventilated without resort to special appliances for that purpose. The fires generally used were of wood, or if coal was employed, it was burned in an open grate. The houses were not hermetically sealed boxes, with double windows, thick walls, and closely fitting doors and window sashes. The old-fashioned fire-place, or even the Franklin grate, gave large egress to the vitiated air, while the numerous cracks around doors and windows furnished sufficient pure air from the external atmosphere. Coal gradually usurped the place of wood for fuel, and compelled the introduction of stoves, furnaces, and ranges, which gave out their heat, not only by imperfect radiation, but by the contact of hot iron plates with the air. This had the effect, in a close room, to destroy the natural humidity of the atmosphere, and for want of ventilation a prejudice against stoves and coal was engendered, as productive of diseases. Perfect ventilation will remove these causes of complaint. The heat generated by the combustion of coal, whether anthracite or bituminous, when burned in a close stove, is not necessarily deleterious.

Oxygen, from its quality of supporting combustion and sustaining life—itself a form of slow combustion—was formerly called the "vital fluid." The effect of a fire in a room is to use up and absorb the oxygen of the air, rendering it unfit for breathing. To sustain life, therefore, as well as combustion, a fresh and continual supply of oxygen is needed. Yet this gas alone, unmixed with hydrogen and nitrogen. is not fit for either purpose—life or combustion. In either case it destroys—acts too rapidly—in one instance producing fever, and in the other destroying the fuel too rapidly. Ventilation, therefore, is as necessary for the fire as for the lungs. The fire of a stove is not the only source of the deterioration of the air in our rooms. Gas lights, lamps, and candles, absorb a large amount of the oxygen, and if the products of combustion are not visible in smoke, or unconsumed carbon, we flatter ourselves that no deterioration of the atmosphere of the room is caused. There is no combustion without the generation of carbonic acid, a gas as fatal to animal organisms as any drug in the apothecary's collection. Because we do not see this in the form of a smoke or a noxious vapor, we provide no means for its escape, and no means for introducing pure air. For our ordinary fires we are compelled to do this, as the results of their combustion would soon render our rooms uninhabitable.

It is calculated that each person consumes, on an average, five cubic feet of air in an hour; or, rather, extracts from it that portion capable of supporting respiration. Put one hundred persons in a room, as a hall, containing 22,500 cubic feet of atmospheric air, a room thirty feet long, twenty-five wide, and thirty high, and in four and a-half hours the air would be unfit to breathe. The increase of carbonic acid gas would soon prove deleterious. It is a beautiful provision of nature that this gas, ordinarily much heavier than atmospheric air, is, when first exhaled from the lungs, lighter than the surrounding air, and rises. In time, however, it cools and descends to our level, when we are compelled to inhale it again. For this reason low studded rooms are not healthy.

But if ventilation of rooms is necessary, it must not be supposed, what some have asserted and attempted to prove, that the proper ventilation of rooms adds nothing to the cost of heating in cold weather. If fresh supplies of air are introduced, these supplies must be heated to produce the requisite temperature, which necessitates an additional consumption of fuel. The object sought is, however, well worth the increased expense entailed.

It is unfortunate that our houses, especially our dwellings, have not been constructed, heretofore, except in rare instances, with ventilation as one of the objects. We must, then, adopt temporary measures to insure a fresh supply. For this purpose the opening of a window at the top and the admission of pure air by a door, or the lower portion of a window, on the opposite side of the room, is the most feasible means for ventilation. Currents of air must be avoided, and this can be done, in a measure, by stretching across the aperture a screen of thin muslin, or, better, perforated thin plates of tin or other metal. To be sure this is an imperfect and not altogether satisfactory method of reaching the object sought, but it is better than no ventilation.

This is a subject too important, and comprising too many conditions, to be justly considered in so brief an article as this. Our object is, however, to call attention to the necessity of proper ventilation, in the hope that it may awaken inquiry and stimulate to some exertion in the right direction. —*Scientific American.*

Copying and Reducing Pictures.

A recent number of the *British Photographic Journal* gives some specimens illustrating this new mode of copying and reducing pictures, or printed or written documents. The number referred to contains a reduced original lithograph picture; and three *fac similes* of different sizes, of an entire page of the journal, all perfectly readable, although one is reduced from a superficies of 73 inches down to 03¾ inches. The process is thus described:—

"A sheet of india-rubber of the thickness of cardboard is fixed by the edges to a suitable frame, the mechanism of which is so constructed as to cause, by the simple operation of turning a handle, the web of india-rubber to be expanded equally in every direction and to any extent. Of the very ingenious mechanism employed for this expansion it is unnecessary for us to speak; let it suffice to say that the action is very uniform and under control. The four sides of the frame to which the elastic web is attached, recede from or approach to each other by manipulating the adjusting screw in one corner. If, when the elastic sheet is expanded, an impression be printed on its surface by means of transfer ink, it is obvious that when the sheet is allowed to contract to any given extent, and the print be then "set off" or transferred from the rubber to a new and polished stone, the resulting picture will be a perfect and reduced *fac simile* of the original. This reduction is much more perfect than could be produced by any artist, no matter how accomplished he be; and coarsely executed work, such as that of the commonest wood engraving, may thus be made to rival the finest steel engraving, so far as fineness in the lines is concerned.

"Impressions from wood engravings and type become exceedingly valuable by means of the Pentagraph, as these, when reduced on stone, produce exquisite résults, and can be altered to suit every purpose without reference to original size; thus effecting immense saving in labor and time, as evidenced in the present illustration.

"The practical value of this invention to a lithographic establishment, may be briefly stated in a few words; for instance, a bill-heading, after being once engraved, and transfers made or impressions taken upon the elastic transfer medium, can be altered and transferred to stone to fit any size of paper. Show cards can be reduced to print as business cards. Transfer impressions taken from wood engravings or type, reduced and transferred to stone, yield printed copies as fine as engravings; crayon, or chalk drawings, when drawn to an enlarged scale and printed on elastic transfer medium, and reduced when transferred and printed from stone are superior to any thing that could be done by the ordinary mode, and this is the only process by which duplicate transfers of chalk drawings can be accomplished that yield impressions superior to the original drawing. Engravings executed to a medium size may be used for obtaining reductions and enlargements, also contorted or metamorphosed, and used for any desired purpose, without the expense of engraving duplicates for each size. Manufacturers using various sized package labels or tickets may have their show cards reproduced as labels for each packet, as suitably as if engraved for the purpose, but possessing this great advantage, that each label, though different in size, presents the same character, thereby rendering imitations difficult and more easily detected.

Slow Poisoning.

He who suddenly kills a man, for the sake of robbing him, is a murderer; we have laws to hang him, and sometimes do hang him. But he who slowly poisons a multitude of people, for the sake of cheating them, is a respectable tradesman; we make him an alderman, congressman, deacon, or bank-director; and he dies full of years and honors, and his children live in the Fifth Avenue.

Philosophers in all ages have amused the people by telling that copper, lead, zinc, and their compounds are poison; yet tradesmen convert them into vessels in which food is prepared, into water-pipes and cocks, and in many ways get them into contact with what we eat. The philosophers occasionally excite the admiration of learned societies by tracing epidemics to poisoned water, or bread, or pickles, or pork, or coffee, or other article of diet; but all this has little effect on "practical men," except to increase their contempt for theorists.

Whether the time will ever come when such foolish things as brass cocks, lead pipes, copper kettles, and zinc tanks will be put away, is a question for prophets rather than for philosophers; but if ever it does come, it is likely that longevity will be considerably increased. Though we can't *see* that a little copper, or lead, or zinc (if it ever really gets into water or food, from vessels that are kept clean) does much harm as a poison (if it really does any harm), we don't like the risk of it. The other day we reported a fellow who had poisoned over 300 people by filling the holes of his mill-stones with lead; that could not be a mistake; but it was too big a dose, and not an argument to prove that brass cocks, copper boilers, lead pipes, &c., can do harm, when kept clean; so practicians assure us. But we have no faith in them.

What, then, shall we use as material for such vessels? Shall we use iron, and make dye-stuff of our tea? If this question be put as a question, and not as an answer, it is well worth considering. What can we make cocks of for the half-million house water-pipes in New York? is a question that may involve a new trade, and the health of a million people.

We have recently seen accounts of turning glass. Boring glass, and molding it, are old processes, which possibly may be improved. Grinding-in stoppers and plugs is a common practice. We have had schemes, that were deemed plausible to men of some talent, to use glass pipes for the distribution of water in houses. On the whole, were we very wealthy, we would rather order glass cocks, at the risk of losing money, than use brass, at the risk of losing health, or even white metal, in which we have no implicit faith. As a cheap article, black glass cocks may be worth thinking about.

The tin-lined lead pipe which is manufactured in New York is doubtless a great improvement, and may last a great many years; but in time the water may get at the lead, and very soon, if the joints be made by inexpert workmen, there may be a trace of poison—more than a liberal man would like for himself and his family. We would rather not have even a suspicion of poison in water-pipes, cocks, kettles, or anything else. For steam-fittings we have no prejudice against brass; but, although we profess the Christian faith, we make too much account of this life to be indifferent to the influences of these poisons, even in homeopathic doses; life is too important to be thus trifled with, even by the righteous, who expect a better life when they cast off their present bodies; what, then, should it be to the great majority of wealthy speculators, who have means and influence to change the practice of the manufacturers of these articles?—*Am. Artizan.*

Pins.

15,000,000 pins are said to be daily called for in Great Britain, in the manufacture of which 2,727 tons of brass wire are consumed. One firm in Birmingham consumes 150 tons per annum.