THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

MARCH, 1865.

## HARD TIMES—THE CAUSE AND CURE.

The *times* are hard! Go where you will, meet whom you may, you hear the same complaint, "Little business doing, and Money scarce." We would in all seriousness ask "how can it be otherwise, managing our business the way we do?" Our clothing, food, drink, and almost every object that can please our various tastes, whether as desirable comforts or mere luxuries, are of foreign production, and are purchased by us without any regard to the ultimate effect upon our prosperity. Let an individual with an income of one thousand dollars a year, habitually spend twelve hundred, and he will very soon have to cry *hard times*, and resort to borrowing to keep up his credit. As it would be with such an individual, so is it with us at present. We annually spend much more than we earn, or, in other words, we import each year on an average, as per table hereto appended, goods amounting to something like $7,000,000 more than we export, and the difference has to be made up by borrowing from other and wealthier countries, and by investments made here by foreign Capitalists in Bank Stocks, Landed Credit Companies, Trust Loan Companies, &c., &c.; the result being that we regularly and immediately spend the money so introduced for imported articles of luxury or comfort, that, in our peculiar circumstances, we ought to do without; and the borrowed capital is sent away to pay for the goods so imported, while we have to continue sending home exchange, or produce, to meet interest on capital expended for what has been of no abiding good to us, but, in too many cases, positive evil.

Of the latter class of articles we may instance the following, as shown in the trade and navigation returns of the Province for the half year ending 30th June 1864:—

| | |
|---|---|
| Ales, Wines and Intoxicating Drinks... | $266,408 |
| Tobacco, Cigars and Snuffs............... | 541,599 |
| Total............... | $808,007 |

We remember hearing, about two years ago, a gentleman who stands perhaps second to no other in the Province as an authority in such matters, state, in the presence of several hundred persons, that "it annually takes the whole value of the large quantity of wheat we export, to pay interest on our borrowed capital." If that is so, how can we realise anything but hard times?

Some of our readers will perhaps remark that times are not always *hard*, that occasionally "business is thriving and money plentiful." We admit that it is so, but it does not generally arise from a healthy state of things. Occasionally we are blessed with an abundant harvest of what, in times past, was the staple product of Canada; but owing to the scourge of the Midge, Weevil, Rust, &c., arising principally from inferior, unscientific, and improvident modes of farming, this does not very often occur. The cause for *good* times have to be sought for elsewhere. The merchant will tell you that the times are good when he has a ready sale for his wares at remunerative prices; the financial statesman when imports are large, and the revenues derived from duties thereon leave him a surplus in the Exchequer at the end of the year, but these things often tend to impoverish and not to increase.

A few years ago the Great Western and Northern Railways were being constructed, and subsequently the Grand Trunk Railway. In connection with these enterprises money was introduced not by *thousands* but by *millions* of dollars. Business was brisk enough then, and money was plentiful; mechanics were well paid, and the farmers got good prices and ready sale for their various products; but in course of time these large undertakings were completed, and but little more money was to be expended upon them. What was the result of the large expenditure that had been made of foreign Capital? Why, as it came unsparingly into the Province, unsparingly it went out. The merchants imported largely of everything that we could eat, drink, wear, or feast our eyes upon; the people freely purchased the goods so introduced, and the money left us almost before we fully realised the fact that we had it; the interest thereon, however, remaining a permanent drain upon the country.

We have not the tables of the years referred to before us, so we cannot tell what amount of luxuries we then consumed; but during the first half of last year we imported of

| | |
|---|---|
| Fancy Goods ............................. | $280,079 |
| Jewellery and Watches ................. | 118,626 |
| Silks, Satins and Velvets ............... | 448,806 |
| Unenumerated articles and small wares, of which say one half belongs to this class, $724,129 ........... ..... | 362,064 |
| Total..... | $1,209,575 |

As with the construction of public works, so is it with "Credit Land Companies" and "Trust Loan Companies." Capital is introduced, and as the Agriculturist is generally in need of money, and his "Improved Farm" offers a desirable security, he borrows and spends and leaves himself in debt, with heavy amounts to pay semi-annually as interest on the expended capital.

Of this last class of operations we would have no cause to complain, if the capital so borrowed was used solely in improving and increasing the productiveness of his land, for then the interest would be returned to him perhaps fourfold. In many cases it is so, but we fear that in too many others a portion of the money so borrowed goes to pay off old debts, another portion probably to secure some additional "comforts of life," or perhaps to add a few more acres to the already ill-cultivated—because too extensive—farm.

Agriculture is not our business, so that probably we may write about somethings we do not fully understand; nevertheless we have a conviction on our minds, that our farm-lands do not produce one-half the crops they would if properly cultivated. The absence of a sufficiency of stock, and want of proper care and shelter of what is possessed; want of drainage and manuring of the old cultivated lands; and too much reliance on wheat as the staple product of the farm, to the neglect of root and other crops, we suppose are amongst the causes of the depression in farming which we have to deplore. There are, of course, numberless instances amongst our intelligent agriculturists, to whom these remarks will not apply, as witness the Annual Exhibitions of the Upper Canada Agricultural Association.

Since penning the above we have noticed a report by a special committee of the Municipal Council of the United Counties of York and Peel, of a Memorial to the Legislature on the subject of encouraging our industrial interests, in which the following passage occurs: "It is universally felt throughout the Province, that the great problem to be solved in its interests must be the discovery of a system of agriculture adapted to the soil and climate, and at least equally remunerative to the former irrational one of exclusive grain produce, which has been conducted with so reckless a disregard to the immutable laws of agriculture, viz.: —the rotation of crops."

Another evil, is, that too many of the sons of our intelligent agriculturists leave the farm for the learned professions and trades of the cities and towns, thus swelling the number following these occupations out of all proportion to the cultivators of the land—the only real source of wealth in a new and comparatively isolated country; and how many of the sons of families in our cities and towns, who with sickly face and puny arm are striving to eke out a subsistence in some overcrowded occupation, would be infinitely better, both in health, circumstances and respectability, if engaged in the manly and honorable occupation of tilling the soil.

Another cause of *hard times* is that we import a great many of the necessaries of life, at a vast annual cost, while we possess the facilities for manufacturing or producing a very large portion of them at home.

From the official tables we learn that from the 1st of January to the 30th of June, 1864, we imported of

| | |
|---|---|
| Brooms and Brushes | $6,439 |
| Blacking | 1,531 |
| Candles | 13,429 |
| Readymade Clothes | 56,809 |
| Cordage | 88,567 |
| Hats, Caps, and Bonnets | 281,197 |
| Hops | 9,808 |
| Hosiery | 119,285 |
| Leather—Tanned | 127,878 |
| Boots and Shoes | 28,763 |
| Other Leather Manufactures | 66,426 |
| Linens | 421,543 |
| Manufactures of Fur | 14,817 |
| Manufactures of Wood | 70,877 |
| Musical Instruments | 56,964 |
| Mustard | 8,282 |
| Oil Cloths | 26,336 |
| Paper and Paper Hangings | 109,019 |
| Pickles and Sauces | 15,626 |
| Soap | 20,513 |
| Spirits of Turpentine | 14,929 |
| Starch | 4,235 |
| Vinegar | 22,862 |
| Woollens | 2,537,669 |
| Broom Corn | 18,482 |
| Butter | 86,348 |
| Cheese | 80,532 |
| Flax, Hemp, and Tow, undressed | 117,673 |
| Lard | 100,184 |
| Pitch and Tar | 5,502 |
| Resin | 50,453 |
| Wool | 241,861 |
| Total | $4,824,839 |
| Wines, Liquors, and Tobaccos, as above | 808,007 |
| Fancy Goods, Jewellery, &c. | 1,209,575 |
| Total imports of goods here enumerated, for six months of 1864 | $6,842,42 |

The total imports of goods of all kinds for the half-year were:

| | |
|---|---|
| Goods paying both specific and *ad valorem* duties | $2,321,821 |
| Goods paying 25 p. c. duty *ad valorem* | 91,464 |
| " 20 & 15 " " | 10,745,395 |
| " 10 " " | 1,148,137 |
| Free Goods—Coin and Bullion | 2,475,504 |
| Other Free Goods | 7,096,826 |
| Reprints of British Copyrights | 3,069 |
| | $23,882,216 |
| Total Exports for same time | 13,883,508 |
| Balance of Imports over Exports for half year | $9,998,708 |

The large balance of imports over exports for the first half of the year is owing, no doubt, to the export of breadstuffs, &c., being so much less than in the latter half of the year.

The total value of imports for the year 1863 was ............ $45,964,493

Total exports for same year were:

| | | |
|---|---|---|
| Agricultural Products | $13,472,134 | |
| Manufactures | 868,782 | |
| Produce of the Mines | 871,549 | |
| " Fisheries | 789,913 | |
| " Forests | 13,543,926 | |
| Animals & their Products | 5,502,633 | |
| Coin and Bullion | 1,685,403 | |
| Other articles | 325,649 | |
| 62 Vessels built at Quebec and exported | 2,287,901 | |
| Total Exports for the year 1863 | | 39,347,890 |
| Balance of Imports over Exports | | $6,616,603 |

The question for us to consider is, how is this state of things to be remedied? We answer, by *importing less*, and *producing more*. Let the people understand their position, and determine to take advantage of it, and of the $6,842,421 worth of imported goods that we have enumerated, at least $4,000,000 worth may be produced by themselves; and with improved systems and modes of Agriculture, our annual exports may be so increased as to make up the balance of, say, two and a half to three million dollars, that would thus stand against us.

The politician will, no doubt, ask where the revenue is to come from, if the imports are diminished to the extent indicated. We answer, put higher duties on mere luxuries, and obtain the balance required by a direct tax, which, under such improved circumstances, the people would be well able to bear. Place the business of the Province in a prosperous position, and there need be no fear of a sufficient revenue being obtained to carry on its government.

The agriculturist, the manufacturer, and the merchant must learn to look upon their respective interests as identical. The farmer cannot prosper, or indeed carry on his several operations of cultivating the soil and disposing of his crops, without the aid of the manufacturer and merchant; and the latter have no basis whereon to build up their prosperity apart from the success of the agriculturist.

We commend the serious consideration of this subject to those most immediately interested in it, and, in conclusion, desire to express our concurrence in the following prayer of the Memorial of the intelligent Counties Council of York and Peel, before referred to:—

"That as agriculture is the basis, so are commerce and manufactures the apex of the social pyramid of national wealth. Your petitioners therefore pray that you will not only grant every assistance towards the establishment of a more fruitful system of agriculture, but also that you may afford every aid, assistance and protection to those manufactures, at least, which are intimately connected with the same, and recognised as springing from the natural productions and resources of the country. As instances of these, your petitioners might mention the culture of vines and tobacco, wool produce, and such manufactures as are generally connected with the agricultural system of the Province.

"That in consideration of the amount of capital at present invested in Great Britain, mill machinery out of work and operatives out of employment there on account of the civil war existing in America; and considering that the state of affairs in the country districts as regards financial matters is not at all encouraging, and that the extension of the manufactures of the country is thought by many to be of immense utility towards ameliorating the difficulties of our position, as no country ever yet has become great and prosperous without manufactures, and also that we possess such magnificent facilities for manufacturing as in the case of many large rivers which intersect and border our country, and mill privileges and appliances at present out of use; your honorable body should use their utmost endeavours to secure the transfer of a portion of such capital, machinery and operatives from Great Britain and other parts to Canada by guaranteeing the protection of their interests for a length of time in case such transfer should come into effect; by making grants of wild lands in favor of such capitalists if thought advisable, and by such other means as may seem most proper and efficacious to secure the desired end."

TABLE.

From the official *Trade and Navigation* tables we learn that, for the last fourteen years, the Imports and Exports of the Province were as follows:

| | | | |
|---|---|---|---|
| 1850.— | Imports | $16,982,068 | |
| | Exports | 11,961,712 | |
| | Excess of Imports | | $5,020,356 |

| | | | |
|---|---|---|---|
| 1851.—Imports | | $21,434,788 | |
| | Exports | 13,810,604 | |
| | Excess of Imports.. | | $7,623,184 |
| 1852.—Imports | | $20,286,492 | |
| | Exports | 15,307,604 | |
| | Excess of Imports.. | | $4,978,892 |
| 1853.—Imports | | $31,981,436 | |
| | Exports | 23,801,300 | |
| | Excess of Imports.. | | $8,180,136 |
| 1854.—Imports | | $40,529,324 | |
| | Exports | 21,249,308 | |
| | Excess of Imports.. | | $19,280,016 |
| 1855.—Imports | | $36,086,168 | |
| | Exports | 24,923,444 | |
| | Excess of Imports.. | | $11,162,724 |
| 1856.—Imports | | $43,584,384 | |
| | Exports | 32,047,016 | |
| | Excess of Imports.. | | $11,537,368 |
| 1857.—Imports | | $41,430,596 | |
| | Exports | 27,006,624 | |
| | Excess of Imports.. | | $14,423,972 |
| 1858.—Imports | | $29,078,527 | |
| | Exports | 23,472,609 | |
| | Excess of Imports.. | | $5,605,918 |
| 1859.—Imports | | $33,555,161 | |
| | Exports | 24,766,981 | |
| | Excess of Imports.. | | $8,788,180 |
| 1860.—Exports | | $34,631,890 | |
| | Imports | 34,441,621 | |
| | *Excess of Exports* .. | | $190,269 |
| 1861.—Imports | | $43,046,823 | |
| | Exports | 36,614,195 | |
| | Excess of Imports.. | | $6,432,628 |
| 1862.—Imports | | $48,600,633 | |
| | Exports | 33,596,125 | |
| | Excess of Imports.. | | $15,004,508 |
| 1863.—Imports | | $45,964,493 | |
| | Exports | 39,347,890 | |
| | Excess of Imports.. | | $6,616,603 |

Average annual excess of Imports over Exports, for the fourteen years, near $9,000,000; or, for the last six years, about $7,000,000 per annum.

## BRANTFORD STONE-WARE WORKS.

On our recent visit to Brantford, we embraced the opportunity of going through the pottery at that place, where Mr. Welding, the enterprising agent and manager, was good enough to facilitate our inspection of the works.

It is not our intention to enter into the art and history of pottery on this occasion, as we published a somewhat lengthy article on the subject not long since, to which we would refer such of our new readers as may not be aware that it is one of the most interesting, as it is one of the oldest arts known to man.

At the Brantford pottery we beheld in busy operation the celebrated potter's wheel, almost exactly as it was in Egypt before the birth of Moses; and the dextrous hands of the workman, forming out of a rude lump of clay vessels of various shapes and uses, with a rapidity and ease really wonderful.

This establishment has been in successful operation, and doing a steadily increasing business for the last fifteen years. It employs some fifteen hands, and the annual value of its products, as we were informed, is about $25,000, which are in good demand throughout Upper and Lower Canada. In *firing* the ware, there are here two kilns, one 14 feet by 11, and 7 feet in height; the other circular, 11 feet diameter and 9 feet in height. To heat these kilns and fire the ware the best pine wood is used, and the process occupies about forty-eight hours—the larger kiln consuming fifteen cords of wood, and the smaller one nine, the yearly consumption being 500 cords. The clay used comes from New Jersey, and produces a fine, light-colored, strong ware for culinary and other purposes, to which, in form and substance, it is admirably adapted.

In the commonest articles there is not wanting a certain chasteness and symmetry of form; while in some, especially pitchers, jugs, &c., are observable many of those elements of beautiful form presented in the antique models. And here we venture to repeat, that the growing taste of the people, created by looking on so many beautiful objects everywhere to be met with, should admonish manufacturers of whatever articles, even the commonest for every-day use, that something more than mere utility is required by the humbler, as well as the higher classes of society. If this be not attended to, they will have no right, and it will avail them nothing, to complain that home industry is not patronized.

As in all potteries of any pretensions, a designer is here engaged for the purpose of giving form to the new articles constantly required to satisfy the demands of the market. Upon the whole we have never seen better ware of the kind, and we have pleasure in adding that there is no poisonous substance entering into the composition of the glaze. For this purpose a kind of clay is used, which is fusible at the heat required to fire the ware.

The skill of the workmen in this place may be judged of by the fact of our being shewn vessels of all sorts of shapes and capacities, from the well formed stone bottle which would hold but one drop, to the barrel of 35 gallons.

Animalculæ have been discovered so small that one million of them would not exceed the size of a grain of sand, and five hundred millions would sport in a drop of water. Yet each of these little beings must have blood-vessels, nerves, muscles, circulating fluids, &c., like larger animals.

## TORONTO MECHANICS' INSTITUTE EXHIBITION.

By an advertisement on the last page of the cover of this number of the Journal, it will be seen that the Directors of the above institution intend holding an Exhibition in their Music Hall and ante-rooms, commencing on the 21st of March, instant. As indicated by the programme, this will be of an entirely different nature to the usual periodical Provincial and local exhibitions held throughout the Province. The latter are almost exclusively for competition between the several producers, and the awarding of prizes to the most successful; and, by reason of the very limited time, and the crowds that usually attend, afford but little opportunity for careful study of the articles shown; nor do they embrace such a wide range of objects as the one now contemplated, which will include not only fine and decorative arts and manufactures, ancient and modern, and of either home or foreign production, but also all departments of natural history, and antique and modern curiosities of every kind; and, in short, any and everything that may tend to instruct or interest the various classes of visitors.

It is also proposed to continue the exhibition for ten days, remaining open each evening till 10 o'clock, thus affording ample time for careful inspection of the various specimens.

We anticipate for it the patronage of Artists, Manufacturers, and Naturalists, for the opportunity it will afford for an advantageous exposition of their various productions; of the Members of the Institute as a means whereby its liabilities may be reduced, and its usefulness increased; and of the general Public for the instruction and amusement to be derived from it.

Former exhibitions of this Institute of a similar nature to the one now proposed, were always found to be very interesting, and, financially, were generally successful.

While on this subject we would suggest to Mechanics' Institutes in other localities, that exhibitions of this kind may be organized with every probability of success, financially and otherwise, if but a few of the individual managers will give their attention to a personal canvas amongst the artists and manufacturers, and the gentry of their respective neighborhoods, who would in most cases *loan* objects for such a laudable purpose. Such entertainments as these tend not only to realise funds, but to create a social good feeling amongst the members and the community generally, which must of necessity re-act to the general prosperity of the institutions.

# Correspondence.

## ON THE MOST ECONOMICAL USE OF STEAM.

*To the Editor of the Board of Arts Journal.*

SIR,—In your notice of the Brantford Engine Works, in the February number of your *Journal*, although that notice is tolerably full, it is not quite complete, there being still some facts or data wanting in order to satisfy the public; at all events, those who have seen the advertisements of that firm during the last eight or ten years cannot be satisfied with the statement simply without the proof. The testimonials given in the same article being very indefinite, and fail to prove the statements as to the duty of their steam engines, as published in their advertisements.

In reviewing briefly the account of the Brantford Engine Works, we may first remark, that it was unfortunate that your visit did not happen at a time when all the machinery was in operation, and that you had not the means of verifying these statements as to economy of fuel and quadrupling the power, as stated therein. We accord to this firm their full share of credit for the enterprise they manifest in driving such an extensive business, which is every way laudable and praiseworthy; at the same time we would remark, that there are other firms in the Province who do as large a business, and who do not require to put forth such statements. Some American millwrights build water-wheels which (they say) give 146 per cent. of the water.* It appears from these statements of the proprietors of the Brantford Engine Works, that they have made fully as startling improvements on the steam engine.

We may pass by the shingle and lath machines, they are now so common that it would be supererogation to treat of them here. The Champion Chopping Mill also.

In trying to prove that steam power is cheaper than water they will have some difficulty in convincing the millowners — and greater difficulty still in convincing their own countrymen, who manufacture the "146" per cent. water-wheels. We have always found, that in a mill with both steam and water power, we never saw the steam

* In the *Scientific American*, some years ago, an article appeared on Turbine Water Wheels, which stated that one of these motors gave 80 per cent. above the overshot wheel; and on its being copied by an agent here, and inserted in a local newspaper, was made to read that these wheels gave 146 per cent. of the water. "The ordinary overshot wheel gives 66 per cent. effective power of the water, 34 being consumed in friction, and in overcoming the inertia of the wheel."

The very best made turbines give only 80 per cent. A water wheel to give 100 is, in consequence of the law of gravitation, an impossibility; yet the American manufacturers find no difficulty from the operations of this law, when they can manufacture wheels giving 146.

engine running and the water-wheel shut down, when there was water enough to drive it. But we have seen, and universally so, the water-wheel running and the engine not at work. In saw mills in many cases, it is more advantageous to apply steam, the fuel being the refuse of the mills; but this is found to be the case with steam engines made by those who do not profess to quadruple the power by any improvements of their own, they only say they will, and do, turn out an engine embracing all the latest improvements both in construction and in design.

In reference to steam grist mills, and their positive statement that there is not one engine in Canada, or North America, capable of grinding one hundred barrels of flour with six cords of wood, we would remark that there are very few engines in the Counties of York, Wentworth or Oxford, that take as much as six cords of wood to the 100 barrels of flour. In all their testimonials you make mention of in your article, it is not stated what quantity of fuel they do consume.

The certain laws and conditions which this firm has practically applied, besides the cut off and double valve referred to, is neither more nor less than "very high pressure steam;" a degree of pressure frequently used in the States, where there is such a total disregard of human life, but fortunately not much used in Canada; and may we always have the same dislike to it. It is well known that the mechanical effect of steam is in proportion to its elastic force, and the quantity of sensible caloric which it contains is in proportion to its temperature; for the laws of the density, specific gravity, and volume of steam at different temperatures, have been found by experiment as follows: that the expansion of steam by heat follows the law which regulates that of other gases, for by the law of Guy Lussac all gases expand from 1 to 1.375 in bulk by the addition of 180° of temperature, or $\frac{1}{480}$ of their bulk for every degree of Fahrenheit. Therefore steam of a high elastic force has not the same proportional additional temperature, since steam of 212° has an elastic force of 15 lbs., or 30 inches of mercury, while steam of 30 lbs., or 60 inches, will not have double 212, or 424, but only 250°. In this property possessed by steam lies all the pecuniary advantage of using high pressure steam expansively.

By using high pressure steam the sizes of the engine and boiler can be made much less, taking less material, and therefore cheaper than with steam of a lower pressure. High pressure steam and a high velocity of piston explains all the improvements adopted by this firm, and this is by making a much more dangerous machine than we care about having beside us in Canada.

There is another disadvantage connected with these engines, which we simply advert to, as, the greater wear and tear resulting from this very high velocity, and consequently, greater expense in keeping up; so that taking all these into consideration, viz.: the additional loss of time in repairs, additional cost of ditto, and the additional danger attending them, we in Canada prefer the safest machine, although it should take a little more fuel.

With very high speeds, a friend of our's naively remarks, "they are all the time running themselves to pieces," and our many young friends know by experience that their "pumps" do not give out so soon in our ordinary Strathspey as in "Tullochgorrum."

In counting the cost it is only fair to do it at the end of say two years at least, and the cost of the Brantford engine will be found to be very little if any less than others of modern construction, and which are much safer than the tullochgorrum engines.

In regard to the "vital" steam used by this firm, it is only another cause of wear. It is well known that by superheated steam the valve and cylinder faces suffer so much from attrition that locomotives with it, after making a single trip, have had to be overhauled.

In conclusion we may add, that there are very few mechanics who could not do all that the Brantford firm say they can do, but in building steam engines it says a great deal for our Canadian builders, that they make it a primary condition to turn out a safe machine, and one that will not require "a horse at the gallop" all the time between the Brantford engine works and the mill with broken pieces of the engine. Z.

## DISTILLATION OF TURPENTINE.

A Correspondent who is engaged in the manufacture of spirits of turpentine, from the Red Pine of our Forests, asks for information which we would be glad to receive from any of our readers who may be competent to give it. In his communication he says:—

"Allow me to ask you whether you can not put me on the track of a better system of *condensing* than by means of a '*worm*.'"

The "worm" is objectionable on several grounds, not the least of which is the rate at which it wears out; and I am of opinion that steam may be condensed in a large wooden pipe, or box, with meta bars driven through it. Will you set me right on the point, and very much oblige,

Yours respectfully, M.

## HOUSE DRAINAGE.

*To the Editor of the Journal of Arts.*

SIR,—Now that spring is approaching, the inhabitants of cities and towns are subject to the annoyance, and also the danger, arising from the offensive and poisonous gases issuing from the service drains of their dwellings; especially is this the case immediately preceding rain or storm, as I know by experience.

Will you, or some of your Engineering friends, furnish a description of the best mode of constructing *traps* at the mouths of such drains, that will prevent the gases escaping into the houses, without interfering with the necessary free drainage of water therefrom.

Yours respectfully,

A SUFFERER.

Toronto, Feb. 25, 1865.

# Board of Arts and Manufactures for Upper Canada.

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| P. P. | Census of Canada, 2 vols | |
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Without tools and the ability to use them, man would indeed be but a poor, bare, forked animal, worse clothed than the birds, worse fed than the jackal, and worse housed than the beaver.

Paraffine has been applied to certain kinds of building stone to prevent the decay to which they have been subject by continued exposure to the weather.

# Selected Articles.

## GOOD FOOD.

BY EDWIN LANKESTER, M.D.

Man, in his wild and barbarous state, like the lower animals, is enabled by his instincts to obtain from the external world those substances which, under the name of food, maintain his existence. It is as he advances in civilisation, and becomes more and more dependent on his intelligence, that he is obliged to use his reason, and to select those foods which are best adapted to the new circumstances in which he is placed. Thus in a wild and semi-barbarous condition, large quantities of food are easily consumed which are utterly incompatible with the health of man in a more civilised state. We also find that man in his civilised condition, by his power of consuming a variety of foods, is enabled to ward off many diseases which rapidly destroy the life of those who are in a barbarous condition. The fact that the civilised races of Europe are less exposed to plague and other pestilences, to scrofula, and many other wasting diseases, depends as much or more on a due supply of healthy food than on all other causes put together. How such beneficial effects are produced it will be the object of this paper to show, by an explanation of some of the laws which govern supply and demand with regard to food in the human system.

If we carefully study the nature of our daily food, we shall find that it is by its agency that all the functions of our body are carried on; that by the aid of fresh supplies of food we live. It is an easy experiment that will satisfy us of this fact. If we get up in the morning and go to our work without breakfast, continue it till dinner-time without partaking of that meal, and go to bed without supper, we shall find how thoroughly all mental and bodily exertion depends upon our food. If we performed this experiment, and weighed ourselves in scales from hour to hour, we should find that we were growing "small by degrees;" and should we withhold nourishment for a sufficient length of time, death would most certainly ensue.

If we examine a little more closely this question of food, we shall find that the chemical elements of the food we take are precisely the same as those of the body. I have calculated that a human body weighing eleven stones, or 154 pounds, contains the following compounds and elements:—

COMPOUNDS.

| | lb. | oz. | gr. |
|---|---|---|---|
| Water | 111 | 0 | 0 |
| Gelatin | 15 | 0 | 0 |
| Fat | 12 | 0 | 0 |
| Albumen | 4 | 3 | 0 |
| Fibrine | 4 | 4 | 0 |
| Phosphate of Lime | 5 | 13 | 0 |
| Carbonate of Lime | 1 | 0 | 0 |
| Fluoride of Calcium | 0 | 3 | 0 |
| Chloride of Sodium | 0 | 3 | 376 |
| Chlor. of Potassium | 0 | 0 | 10 |
| Sulphate of Soda | 0 | 1 | 170 |
| Carbonate of Soda | 0 | 1 | 72 |
| Phosphate of Soda | 0 | 0 | 400 |
| Sulphate of Potash | 0 | 0 | 400 |
| Peroxide of Iron | 0 | 0 | 150 |
| Phos. of Potash | 0 | 0 | 100 |
| Phos. of Magnesia | 0 | 0 | 75 |
| Silica | 0 | 0 | 3 |
| | 154 | 0 | 0 |

ELEMENTS.

| | lb. | oz. | gr. |
|---|---|---|---|
| Oxygen | 111 | 0 | 0 |
| Hydrogen | 14 | 0 | 0 |
| Carbon | 21 | 0 | 0 |
| Nitrogen | 3 | 8 | 0 |
| Phosphorus | 1 | 12 | 190 |
| Calcium | 2 | 0 | 0 |
| Sulphur | 0 | 2 | 219 |
| Fluorine | 0 | 2 | 0 |
| Chlorine | 0 | 2 | 47 |
| Sodium | 0 | 2 | 116 |
| Iron | 0 | 0 | 100 |
| Potassium | 0 | 0 | 290 |
| Magnesium | 0 | 0 | 12 |
| Silicon | 0 | 0 | 2 |
| | 154 | 0 | 0 |

Now I do not claim for these quantities anything more than a rude approximation to the truth; but as no one has yet analysed a whole human body, we may take these calculations as representing the composition of a human body.

Now these substances are not fixed in the human body. They are all of them constantly undergoing chemical change, and the result of this chemical activity is what we call life. One of the necessary conditions of the life of the body is that it be placed in an atmosphere containing oxygen gas. Our atmosphere contains 79 parts of nitrogen and 21 parts of oxygen in every 100. This oxygen is being constantly taken into the human body. If we prevent the oxygen getting into the lungs by hanging, drowning, or any process, the person is suffocated. It is the oxygen which consumes the body. Just as a burning candle is consumed in the air, so is the human body. The oxygen attacks the carbon in the system and forms carbonic acid; it unites with the hydrogen and forms water. It has been calculated that twenty-four ounces of oxygen are every day taken into a human body weighing 154 pounds. This oxygen does not remain in the human body, but comes away from it again in the form of carbonic acid gas, which is thrown from the lungs. Twenty-four ounces of oxygen will unite with eleven ounces of carbon to form thirty-five ounces of carbonic acid, and this is the source of the diminished weight of a human body when food is taken.

In addition to this, I calculate that there passes from the body one hundred and three ounces of water; fifty one by the kidneys, thirty-one by the lungs, sixteen by the skin, and five by the alimentary canal. In addition to the water, there are dissolved in it two ounces and a half of soluble salts, including urea (a substance containing nitrogen), and about two ounces of insoluble matter. In all, a body weighing one hundred and fifty-four pounds loses every day about one hundred and forty-three ounces.

In living, moving, and acting, then, the human body loses about a sixteenth of its own weight every day. The supply for all this waste is food. The necessity for food is this waste. If we examine the composition of food we shall find that it has in it the same compounds and the same elements as we find in the human body. If we place all the variety of foods which man consumes, from his first meal in the morning to the last at night, under chemical analysis, we shall find that they only contain the elements of his body. Nay, four of these are so prominent above all the rest that recent writers on dietetics confine their attention principally to these four, namely,—carbon, hydrogen, oxygen, and nitrogen. In a body weighing one hundred and fifty-four pounds, they form one hundred and forty-nine pounds and a half.

We now begin to see how science is teaching man the difference between good and bad food. That food alone is good which has a proper quantity of each of the elements of which the body is composed. It must not, however, be supposed that the immediate destination of the food is to be carried into the blood, and there to undergo the changes which result in the waste to which we have referred. No; the food is first taken into the stomach, and there undergoes physical and chemical changes which fit it to become blood. The blood supplies all the organs with the new matter, and receives from them the old, effete, or used matter which is the portion of the body that becomes waste and passes from it. The body is thus hourly, nay constantly, being built up and taken down. The physical and chemical forces, acting on particles of matter too minute for even microscopic vision, are perpetually performing this great work, and the grand result of this perpetual activity is life. It is thus that the body in which we live is perpetually passing away. It changes from hour to hour and from day to day. Some portions of the body pass rapidly away, as the muscles, nerves, and soft parts generally; whilst others, as the skin, the nails, the hair, and the bones, more slowly change. But, on an average, it would appear, of about forty days, the whole body disappears. The mould remains, the consciousness of existence remains, some kinds of inorganic matter, accidentally introduced remain; but the great bulk of the material particles of the body have in that time all passed away. We pass to our graves many times before the last mass of particles of which we are conscious as our body is carried to its tomb.

Although our food consists of the same ultimate elements, and these are arranged frequently into the same compounds as our bodies, it nevertheless assumes a variety of forms which admit of tolerably precise arrangement and classification. Some substances used as food are distinguished by containing large quantities of water; others present us with carbon or nitrogen as their distinguishing ingredients; whilst others, again, exert a medicinal action on the system, or are comparatively inert.

The kinds of food which are most necessary to life, and most abundantly taken, are those which contain more or less of the four organic elements, carbon, nitrogen, oxygen, and hydrogen. Of these four elements, the carbon and the nitrogen are the most important. Carbon, which, in its pure state, exists as animal or vegetable charcoal, graphite or blacklead, and the diamond, is an inflammable substance, and, as we have already stated, is constantly combining with oxygen in the body, and forming carbonic acid. It is principally by its agency that the heat of the body is maintained. It exists in all the more common articles of our food, more especially in those substances known by the name of starch, sugar, and fat. We shall therefore speak of these substances separately.

*Starch* is universally present in the vegetable kingdom. It exists in the cells of plants, in the form of minute granules, varying from the $\frac{1}{3000}$ to the $\frac{1}{10000}$ of an inch in diameter. It is contained in wheat, barley, oats, rye, rice, maize, and potatoes, and constitutes almost the entire substance of sago, tapioca, and arrowroot. We thus see how largely it enters into the composition of our daily food. Chemically, it consists of seventy-two parts of carbon and ten parts of water. Starch is insoluble in water; but, when mixed with saliva, it is converted into sugar, and thus becomes soluble. Starch does not enter the system unless it is first converted into sugar. The value of starch as a food depends on its introducing carbon into the system. Starch, then, is one of the means by which carbon is introduced into the system, and is called on that account, by Liebig, a heat-giving food.

Starch, in the plant, is constantly converted into *Sugar*, and sugar is taken by man as food, as it saves him the trouble of converting starch into sugar. It is contained in many plants, especially in fruits; but it is separated from the sugar-cane and other plants, and used by man in its pure state. It supplies carbon for the animal stove, and is justly regarded as a heat-giver.

Starch and sugar are converted in the vegetable system into fat by the loss of their oxygen. Fat contains large quantities of carbon and hydrogen, but very little oxygen. The consequence is that when fat, in any form (whether what we call butter, lard, suet, or oil), is introduced into the system, it offers hydrogen as well as carbon for combination with oxygen. For the purposes of maintaining animal heat one pound of butter or oil goes as far as two pounds of sugar or two pounds and a half of starch. It frequently happens in the animal system that, when the carbon of the sugar and starch is not required for animal heat, they lose their oxygen and become converted into fat. In this way they are deposited in the system, and animals fed on an excess of starch and sugar become fat. In the summer season, when the animal system has less demand for heat, herbiverous animals become fat. Man himself becomes fat at this season by consuming the usual quantities of starch and sugar. This is a point of great practical importance to those who do not wish to become fat. It is not only necessary that they should not consume fat, but that they should not consume those substances which contain starch and sugar, and which, if taken in larger quantities than suffice to maintain animal heat, are converted into fat.

Fat and its analogues, butter, suet, and oil, are not only taken as a means of supporting animal heat, but are found essential to the development of some important tissues. Muscles and nerves cannot form without fat. Hence it is that in those states of disease where wasting of the tissues occurs, one of the best possible remedies is fat; and so important is this, that the introduction of animal fat, in the shape of cod-liver oil, has been found one of the most important remedies in all cases of wasting disease.

On the other hand, there are deranged conditions of the system in which the sugar and fat are not oxidised, but are deposited in the form of adipose tissue in the system. This adipose matter either accumulates from this cause, or from the too free ingestion of sugar and fat. The remedy in the latter case is simply to stop the supplies; the treatment in the former case demands more inquiry, and consists in the removal of any impediment which may exist to the free oxygenation of the carbonaceous materials.

A second group of foods are those which, in addition to carbon, hydrogen, and oxygen, contain *Nitrogen*. The nitrogen does not exist in these substances in large quantities, but it is a distinguishing ingredient. We have seen that two substances exist in the body called fibrine and albumen, the former entering into the composition of the muscles, the latter that of the nerves. Now these substances are contained in our vegetable food, and it appears that they are directly conveyed from the vegetable to the animal. We have no knowledge of any power in the animal system to manufacture these substances. All the nitrogen which is contained in an animal is derived from the vegetable kingdom. It is the peculiar property of the plant to be able, in the minute cells of which it is composed, to convert the carbonic acid and ammonia which it gets from the atmosphere into fibrine and albumen. By easy chemical processes we can separate these substances from our vegetable food. Wheat, barley, oats, rye, rice, all contain fibrine, some of them also albumen. Potatoes, cabbages, and asparagus contain albumen. It is a well-ascertained fact that those substances which contain most of these "nutritious secretions" as they have been called, support life the longest. Liebig calls them "flesh-formers." They undergo little change during digestion, and present themselves in a pure state in the blood, where they are directly employed in the renewal of nervous and muscular matter. They are the agents which renew the thinking and working powers of man. They are probably destroyed at the same moment that the carbon is converted into carbonic acid gas, but in their last stage they pass off from the body in the form of urea. The nitrogen lost in the destruction of the fibrine and the albumen is found in the nitrogen of the urea. Mere existence is represented by the loss of carbonic acid, but the work of the system in its thought and its muscular labour is represented by the nitrogen of the urea. Nor is this the mere dream of the theorist: it has been practically demonstrated that increased stress upon the nervous system, viz., brain-work, emotion or excitement from disease, increases the quantity of urea and the demand for nitrogenous food. In the same manner the amount of urea thrown off is the representation of the amount of muscular work done.

Important as these two groups of food are, they do not exhaust all that is necessary to constitute "good food." In addition to the compounds of the four organic elements, the human body requires certain saline constituents, without which it cannot exist. These are the five pounds of phosphate of lime, the pound of carbonate of lime, the three ounces of fluoride of calcium, the three ounces and a half of common salt, with the other salts. They are all passing off from the body at the rate of about one ounce in the twenty-four hours. It is not much; but then it must be supplied, or disease, dire and fatal, sets in. It will not do to supply one salt for another. Spare the lime salts, and the bones give way, and rickets, crooked spines, and feeble bones are the result. Give up eating salt, and the blood suffers, the cheeks get pale, the liver refuses to perform its functions, and the frame goes to rack and ruin. Eat as much lime and soda as you will, the muscles will fail to do their duty without potash. Scurvy sets in, and all its frightful consequences are the result. But how are we to know where to get these things? With the exception of common salt they are none of them brought to the table. I think they might be brought to the table; a mixture of the phosphate of lime, and soda, and the chloride of sodium and potassium, might be added to our food in such a way as to secure a due supply. But even the nineteenth century Englishman is not sufficiently civilised to act upon his reason at present, and therefore no attempt will be made to introduce them directly into the system, although they can be demonstrated to be necessary. In the meantime we may comfort ourselves by a knowledge of the fact that all our vegetable and animal food contains a certain quantity of these mineral constituents. If we turn to tables of analyses of various kinds of food, we find that in every pound wheat contains a quarter of an ounce of mineral matter; potatoes, the eighth of an ounce; and cabbages, lettuces, watercresses, fruits, and especially tea, contain large quantities of these mineral matters. So that we really get them in our ordinary food; but we may have them in too small quantities,—especially may they be deficient in boiled food, unless the water in which it is cooked be taken in the form of broth or soup. I especially recommend to my countrymen the practice of habitually taking soup, which contains dissolved in it mineral substances. To soup should be added fresh vegetables of any kind that are in season. The beneficial effects of the potato as an article of diet are more to be attributed to its mineral than other constituents. To banish potatoes from the diet without substituting other vegetable food, is to invite the most destructive diseases to which the human frame is liable.

Amongst the mineral constituents of our food must be placed water. One hundred and eleven pounds out of the hundred and fifty-four of a human body is water. We are not so completely organised water as jelly-fishes; but we are, nevertheless, exceedingly watery beings. The water of which our bodies are composed passes away at the rate of one hundred ounces a day; and if we drink largely, larger quantities are accordingly given off from the various excretory organs. Water is contained in all our solid food. More than half the bulk of our meat, bread and vegetables is water. Water is therefore one of the most important constituents of our food. Everything we take is first dissolved in it before it can be taken up and get into the blood; and none of the tissues can grow up, and be taken down to serve the purposes of life, without its agency. It is the great primal substratum of organic life, with which the organic and other elements are worked, for the purpose of producing all the forms of animal and vegetable life. Of all the constituents of the body it alone remains unchanged. It flows through our life like a tide, and our bodily forms are, as it were, reflected from its surface by their physical properties, even as the sun produces the perfectly formed rainbow from the falling waters of a cataract.

There is yet another group of substances entering our food that demand attention. They are not taken for the purpose of promoting animal heat, nor do they take a part in the fabric of the body. They simply address themselves to the nervous system, producing either directly or indirectly, agreeable impressions. Some of them are employed to season food, and address themselves to the palate. Such are the various forms of condiments, spices, and flavours. Others act upon the nervous system after they have entered the blood, and produce their effects upon the brain and spinal cord. Such are theine, contained in tea and coffee; alcohol, contained in wines, spirits, and beer; nicotine, in tobacco; and morphine, in opium. It is impossible to exclude the consideration of these things in estimating the nature of "good food," although many of them have been regarded as having no claim to the title of food at all. I have elsewhere called them medicinal or auxiliary foods. We may dismiss the consideration of condiments, spices, and flavours, in a few words. They may be used or not, at pleasure, and, where food is otherwise good, no especial need for them is felt. At the same time, they are extensively employed, and wherever man is rescued from the barbarism of eating merely heated food, there condiments and spices will be employed. Scarcely any human act is a better index of civilization and culture than the care taken in the preparation and flavouring of food. The careless preparation of food is at once wasteful and unhealthy. It leads to the destruction of that which is available for the life of the body, and produces those diseases which, commencing with indigestion, end with fevers, brought on by an unhealthily constituted blood.

There are three things in this group of substances which demand a word or two of notice. These are theine, alcohol, and tobacco.

Theine is a compound formed in tea and coffee, and which can be separated in the form of white crystals. When given to frogs it speedily paralyses and shortly after kills them. It therefore undoubtedly acts on the nervous system, and it is probably this paralysing or sedative action that commends theine to the busy, excited populations of Europe. It should, however, be remembered that it is a poison, and may be taken to excess. I have known many instances of severe dyspepsia and a long train of nervous symptoms immediately disappear on the suspension of tea and coffee.

Alcohol is another substance which addresses the nervous system. It first excites and then depresses and overcomes. It has been the great tempter and curse of man since the days of Noah. It has been praised by poets and praised by prophets, and, again, driven from society as a devouring beast. It may, perhaps, be safely advanced that, with his present tendency to abuse this substance, man would be better without it. Nevertheless, if guided by reason, it may be made by man an alleviation of his sorrows, a protection to his health, and a harmless contribution to the pleasures of his social meals. The great question is, how much may be taken from day to day with impunity. Without going into any question of its action on the system, whether it is partly burned or all got rid of by the secretions, I would say that my experience is that a healthy man, taking open-air exercise every day, cannot safely consume more than two ounces of alcohol daily. Roughly, this quantity is represented by a pint of strong ale, or a quart of London porter, or four glasses (or eight ounces) of port or sherry, or eight glasses (or sixteen ounces) of hock or claret. More than this may be excess; but every man should be the judge of his own requirements. When alcohol affects the head, or produces thirst, or deranges the stomach, or liver, or kidneys, it should be given up or reduced. There is no doubt, however, on my mind that men, women, and children can maintain their health through long periods without having recourse to alcohol at all.

Tobacco cannot be regarded as a food at all: at best it is but an indulgence. Nevertheless, indulgence is lawful, and the question comes as to what injury is inflicted on the system by tobacco. Like other narcotics it obeys the law that, if a second dose be not taken till the effect of the first is gone off, it can produce no permanent injury on the system. Tobacco smoke has not the power which alcohol possesses of destroying the tissues and interfering with the nutrition of the body, and consequently, even when taken to excess, does little harm as compared with alcohol. Its allurements for mankind have been much more universal than even alcohol. With the exception of a few European and American women, the whole human family smokes. If it be a vice, its evils are so small and its fascinations so great, that it may most certainly be prophecied that it will be one of the fixed habits of humanity for all time to come.

Leaving, then, the last two groups of food, let us consider the first two groups, those which comprise the great bulk of our aliment from day to day. In order to the understanding of this subject, I have drawn up a table of the daily supply and waste of a human body, weighing eleven stones and measuring five feet eight inches in height.

| TAKEN IN. | | OZ. |
|---|---|---|
| I.—*Gases.* | | |
| Oxygen .................... | | 24 |
| II.—*Liquids.* | | |
| Water :— | | |
| In beverages.. | 68 oz. | |
| In solid food.. | 25 | |
| | — | 93 |
| III.—*Solids.* | | |
| Flesh producers :— | | |
| Fibrine .......... | 3 oz. | |
| Albumen and caseine ....... | 1 | |
| | — | 4 |
| Heat-givers :— | | |
| Starch ......... | 12 oz. | |
| Fat or butter. | 5 | |
| Sugar .......... | 2 | |
| | — | 19 |
| Indigestible :— | | |
| Gelatine......... | 1 oz. | |
| Cellular .......... | 1 | |
| | — | 2 |
| Mineral matter........... | | 1 |
| | | 143 |

| GIVEN OUT. | | OZ·GR. |
|---|---|---|
| I.—*Gases.* | | |
| Carbon......... | 11 oz. | |
| Oxygen ......... | 24 | |
| | — | 35 |
| II.—*Liquids.* | | |
| Water :— | | |
| By kidneys. | 51 oz | |
| By lungs... | 31 | |
| By skin...... | 16 | |
| By alimentary canal | 5·237 | |
| | ——— | 103·237 |
| III.—*Solids.* | | |
| Insoluble............... | | 2 |
| Soluble :— | | |
| | oz. gr. | |
| Urea.......... | 1·200 | |
| Salts. ......... | 1 | |
| | ——— | 2·200 |
| | | 143·000 |

This analysis has been founded upon an extensive analysis of the dietary of soldiers, sailors, prisoners, and the diet of the better paid class of artisans and professional classes in London.

The solid substances named in the "taken in" list are found in the common articles of diet, in the meat, the bread, the flour, the vegetables, the cheese, the butter, the sugar, that we take at our ordinary meals. It will be seen that the proportion of heat-givers to flesh-formers is as five to one; but if we include the indigestible and innutritious matters—the gelatine and the cellulose—as is usually done—with the flesh-formers, then the proportion of the heat-givers is about four to one. It must, however, be always recollected that in attempting to frame a diet by weight, some substances are less digestible than others, and therefore cannot be relied on as food at all. Unmasticated starch passes through the alimentary canal without change. Coarse, tendinous meat is frequently not digested at all. Woody matter, cellulose of plants, is not digested at all. Cheese, though containing large quantities of caseine—a substance resembling albumen—is very indigestible in its hard state, though easily digestible in its fresh and soft state. The consideration of the *digestibility* of food is of the utmost importance, without which our best framed dietaries may fail of their end.

There is one result of diet that is at the present day exciting a large amount of public interest, and that is the tendency of the adipose tissue to become developed to such an extent as to interfere with freedom of motion and other healthful actions of the system. The tendency to deposit fat is undoubtedly a peculiarity of some individuals of the human race, as well as of whole races of the lower animals. The breeds of sheep, pigs, and oxen that fatten fastest are most valued for the meat market. This property more often depends on a power of consuming large quantities of heat-giving foods than on any other state of the system. It is generally, therefore, a very easy thing to reduce corpulent persons, by restraining them in the indulgence of heat-giving foods. Eat no butter at breakfast and no bread at dinner is a recipe which, when scrupulously followed out, I have generally found act favourably on stout persons. An intelligent apprehension of the general facts I have mentioned will enable persons of a little energy to reduce themselves when and as much as they please. It is, however, a dangerous practice to attempt to reduce corpulent persons by empirical means. Strong exercise, sweating, vinegar, solution of potash, and abstinence from all kinds of heat-giving food, are alike dangerous, and must sooner or later end in some fatal catastrophe. On the subject of reducing corpulence Mr. William Banting has given an instructive and amusing account of his own experience in a letter which he has published. Although not very corpulent, the adipose tissue had collected in those parts of the body which interfered with the circulation, and in the course of a few weeks, by discontinuing a most injudicious and unlimited dietary for one which his medical man had the great judgment to prescribe by weight, he soon lost his fat and the inconveniences that attended its presence. It would, however, be highly injudicious for any person, unless placed under the same circumstances, to follow Mr. Banting's course of diet.

The diet he pursued,—for every one who knows anything about diet must hope he is not still pursuing it,—is objectionable from many points of view. Thus, excepting salmon amongst fish, and pork amongst meats, is fanciful. Salmon contains less fat than many fish, and lean pork is not so fattening as fat mutton. The exclusion of milk from the diet is also objectionable, as milk conveys, in the most digestible form, nutritive matter to the system. Again, the exclusion of potatoes from the diet is a great mistake, as they contain mineral elements that are not so abundantly supplied from other sources. Why champagne and port are excluded from the wines, whilst sherry and Madeira are admitted, would puzzle those who looked at the dietary from its anti-pinguidaceous point of view. There is no reason in excluding beer, if ten or twelve ounces of wine be allowed. Provided a man be not of active habits, a dietary like this might quickly plunge him into evils to which those of corpulence are a mere trifle.

At the same time there can be no doubt that Mr. Banting has been reduced by the withdrawal of starch, sugar, and fat from his dietary. He complains that no one ever thought of this in his case till the year 1862, when he began to reduce himself. He will, however, find ample directions given for the reduction of obesity in an article on that subject which I wrote for the *English Cyclopædia* in 1859, and which was only the result of my teachings in my lectures on dietetics for the foregoing fifteen years.

The question, however, of fat accumulating in particular parts of the body so as to produce disease is quite a different one to that of corpulence. Many corpulent persons enjoy excellent health, and I strongly recommend them to let well alone. It is, however, a desirable thing when persons are suffering in health to know really what men ought to weigh. We are indebted to the late Dr. John Hutchinson for weighing above two thousand six hundred men at various ages. Having worked with Dr. Hutchinson in the early part of his researches, I was struck with an obvious relation between the height and the weight of the persons he so pertinaciously weighed and measured, and I discovered that, starting with the lowest men in his tables, it would be found that the increase of weight was as nearly as possible five pounds for every inch in height beyond sixty-one inches. The difference between the observed height and weight and the calculated weight will be seen in the following table:—

| Height. Inches | Observed Weight. lb. | Calculated Weight. lb. |
|---|---|---|
| 61 | 120 | 120 |
| 62 | 126 | 125 |
| 63 | 133 | 130 |
| 64 | 139 | 135 |
| 65 | 142 | 140 |
| 66 | 145 | 145 |
| 67 | 148 | 150 |
| 68 | 155 | 155 |
| 69 | 162 | 160 |
| 70 | 169 | 165 |
| 71 | 172 | 170 |
| 72 | 176 | 174 |

This is so generally true, that in the course of many years' observation I have seen only a few cases in which an excess upon these weights could be attributed to any other cause than an excess of adipose tissue. To the medical man these tables will be found of advantage, as guiding him in giving dietetical advice in certain cases of disease.

Whilst the excessive supply of heat-giving materials in diet is likely to engender corpulence and its attendant evils, it ought to be recollected that the withholding a due supply of these substances is likely to be very injurious. It has been found that a certain quantity of fat is a necessary addition to all dietaries. It enters into the food of all peoples, and exists in small quantities in all kinds of vegetable food. It has been found deficient in the body in certain wasting diseases, as consumption; and the most efficacious remedy in this disease is an animal oil, which, being easily digested, speedily supplies the system with the needed fat. Articles of food containing fat may be efficiently used as substitutes for cod-liver oil. Thus for children I am in the habit of recommending cream and cream-cheeses. The latter soft and digestible form of food is, I believe, too much overlooked in the diet of the scrofulous and consumptive. The use of salad oil and fat meats is also to be recommended under the same circumstances.

If it be important to regulate the supply of the heat-givers, it is not less so to supply the flesh-formers. To diminish these and under-supply the body, is to tax the muscles, to tax the heart, to tax the brain. It is to let the system down till one or other of its complex arrangements goes wrong and death results. I have said that four ounces of these present constituents of our life are necessary. They form the substance of muscle and nerve, the foundation of all handwork and headwork. Just in proportion as we work with our heads and hands do we require these flesh-forming matters. "On what principle do you discharge your men?" I once said to a railway contractor. "Oh," he said, "it's according to their appetites." "But," I said, "how do you judge of that?" "Why," he said, "I send a clerk round when they are getting their dinners, and those who can't eat he marks with a bit of chalk, and we send them about their business." Quite right, Mr. Contractor. No man can work without eating; but he must eat fibrine, albumen, and caseine. Instinctively the navvey and the author find out the food that contains most flesh-forming matter. But it is fathers and mothers, and masters and mistresses, who feed others by rule, that should know the nature of "good food." Above all, it is the Government of this country, which feeds soldiers, sailors, paupers, and prisoners, that should know these things. After an examination of the public dietaries of this country I have no hesitation in saying that the knowledge of what is good and proper food is much greater amongst the public generally, than it is amongst our Government officials. No doubt, great improvements are taking place, but many of our public dietaries are at the present moment little short of being disgraceful.

The question, then, comes as to the best way of supplying the needed four ounces of flesh-forming matter. Any table of food analysis will show us approximately how this may be obtained. It is contained in a pound of beef; in two pounds of eggs; in two quarts of milk; in a pound of peas; in five pounds of rice; in sixteen pounds of potatoes; in two pounds of Indian meal; in a pound and a half of oatmeal; and in a pound and three-quarters of flour. But it would be highly injudicious to give any of these things continuously. The system seems to delight in variety, and the constant supply of the same food day by day becomes disgusting and is dangerous to life.

Of all substances used as food which can be longest borne, and is freest from objection, is milk. Milk is the natural diet of the young; it contains all the elements of the nutrition of the body; it supplies the deficiencies of other articles of diet; and when it cannot be got both young and old suffer, but especially the young. Wheaten bread, next to milk, can be longest endured as a single article of diet; but men would starve on bread alone. Hence the necessity not only for quantity, but for variety, in food. Variety will not, however, make up for quantity: where there is not a supply of twenty-eight ounces a week of flesh-formers there is under-feeding; under-feeding means starvation. This is a question of national importance. It is vain to expect either brain or muscles to do efficient work when they are not provided with the proper material. What fuel is to the steam-engine, "good food" is to the human machine. Neither intellectual nor physical work can be done without "good food."

## APPLIANCES FOR VENTILATION.

By Mr. Thomas Oliver.*

Another important part of the ventilation of our large towns was being rapidly done away with; he referred to trees. Where, on the Leazes and certain parts of the Moor, trees would be highly conducive to the purity of the atmosphere, rank grass now grew. Referring to dwelling houses, he said that, after a dry foundation, free circulation of air should be secured. Bad as closed rooms were, they were not so deleterious as closed fire-places and closed chambers, every hole in which was stuffed in some houses to keep out air; hence the rooms are full of poison, which the sleeper breathed. After quoting Miss Nightingale's opinions, he advised that chamber windows should be kept open top and bottom all day, and slightly opened at night. The Nuisance Inspector of Newcastle had told him that on 29th of June last he had made some observations in the neighbourhood of Northumberland-street, and in 415 houses there were only 111 windows open, and not one of these was opened top and bottom. The present system of building water-closets was condemned, as they acted simply as ventilators to the drains and cesspools of a house; they should be built out, and shut off by double doors. Among our public buildings courts of law were so ventilated that in the morning they were cold, at noon they were sweaty, and in the evening positively suffocating. Churches and chapels were now better ventilated than formerly, and public halls and hospitals were both comfortable and healthy. When any member should go to Paris, it would certainly be worth his while to visit some of the hospitals there, which were ventilated on scientific principles. * * * * Mr. Oliver then passed on to examine several modes of ventilation. He said:—By modes of ventilating I do not mean elaborate systems. I have no faith in "systems," as they are called, for ordinary purposes. As a rule, the simpler the construction the better the operation. All systems resolve themselves into letting air in and pushing air out. The laws of nature are arranged for this. But the difficulty lies in securing just the quantity of pure air required, without causing unpleasant draughts at the place of ingress. So far as I have been able to learn, there have been but three modes of ventilation suggested. 1st. Where the inlet is

*Abstract of Paper recently read before the Northern Architectural Association.

from above, and the outlet from below. 2nd. Where the inlet is from below, and the outlet from above. 3. Where the inlet and the outlet are combined.

1st. I do not know any patentee who advocates, at the present day, the admission of pure air from the top of a building or apartments, and the expulsion of foul air from the bottom, except an American!* True, Sheringham's valve is always placed near the ceiling, but it is usually used in conjunction with an Arnott's valve, which lets out the foul air at the top. The American plan, like most of the previous plans based on this principle, is in connection with warming. The idea is to take the rarefied air to the top of the apartment and bring it downward till it forces the cold air out! Now, the carbonic acid and the vapour from the body and the lungs, being specifically lighter than the air of the room, will naturally ascend, and by gradually mixing with the pure air will necessarily vitiate it, and in returning again will be respired in this condition.

2nd. The most usual mode, whether in connection with warming or not, has been to admit the pure air from below and expel it from above. This is an obvious mode of ventilating, which is daily illustrated by a window open at top and bottom, where it will be found that the air comes in from below and goes out from above: or by an open door, where, by holding a light, it will be seen that the light is forced into the room when held near the floor, and out of the room when held near the top of the door.

3rd. The popular and most modern plan, however, is that of the combined action. I believe Mr. Watson, of Halifax, obtained the first patent; but, in a modified form, it is the subject of several other patents. I saw it in operation in a model in Manchester a few years ago. A glass bottle without a bottom, about 15 in. by 6 in., with a 6-in. neck 2 in. diameter, was set upon a table. A lighted candle about 3 in. long was placed inside. The candle burned brightly for a few seconds, and then gradually the light began to die downwards. As the oxygen was consumed, the wick of the candle became soft, and the light sunk to the lowest ebb. At this point a small wooden division was placed within the neck of the bottle, dividing it into two, when instantaneously the light revived, and in a few seconds it burnt brighter than ever. I could distinctly trace the action of the down and up current, one on either side. Such is what I call the combined mode. But it may have four openings instead of two, or it may have a tube within a tube, with an open space between. It is neither more nor less than the up and down shaft of mining ventilation—the principle being just the same.

I do not deem it necessary to enter into the distinctions made by some writers dividing artificial ventilation into two branches, which they call plenum and vacuum—plenum being the system of forcing air, by mechanical contrivances into buildings, and allowing it to escape by openings made for the purpose; vacuum being the system of drawing the foul air out of the buildings by mechanical contrivances, and to allow the pure air to enter by openings or channels made for the purpose. Nor do I think it necessary to more than refer to those systems that require fans and other artificial efforts, seeing that these are special cases, and of course require special considerations; as, for example, the Houses of Parliament, or the ventilating of a public building in a hot climate.

I now refer you to the patents based on these three modes, and I find these patents may be classified as follows:—1st. Those that only admit cold atmospheric air. 2nd. Those that only extract foul air. 3rd. Those that admit cold atmospheric air and extract the foul air simultaneously. 4th. Those that are in connection with warming and the admission of pure air. 5th. Those that are in connection with lighting and the extraction of foul air.

1st. The principal ventilators under the first head—being those that only admit cold atmospheric air—are the external sliding ventilators; the revolving circular floor ventilators; the fanwheel pane ventilators, and, chief of all, Sheringham's wall ventilators. Sheringham's ventilator has risen rapidly into popular favour, and deservedly so, for perhaps no mere inlet ventilator answers its general purpose so well. Similar to the Arnott valve, it can be regulated at pleasure by a string suspended from it. It is usually placed near to the ceiling of a room, and, when used in conjunction with an Arnott ventilator, the effect is generally immediately and appreciably satisfactory.

2nd. Those ventilators that only extract foul air are represented by Arnott's valve ventilator, Chowne's reversed syphon ventilator, Chadwick's archimedean revolving ventilator, and Doulton's double flue extractor. Every one knows the Arnott ventilator; but very few, perhaps, know the extraordinary action of the reversed syphon ventilator. I think it was in the year 1850 that Dr. Chowne invited me to see him experiment at his residence at Hyde Park, in connection with his patent. The first experiment was made in the open air. A gutta percha tube, about two and a half inches in diameter, was secured to the chimney of his house—perhaps from 50 to 60 ft. high—and brought down the outside of the wall, and afterwards carried along the footpath of the garden some 20 to 30 ft. A portion at this end was raised to a height of about 4 ft. The question now was, Is there any action going on in this tube? The docter lighted some touch-paper, and held the lighted paper within half an inch of the tube. The result was that the smoke went direct to the mouth of the tube at an easy pace, and when once there it rushed vehemently down and away! Another experiment was inside. He made the chimney of his study the long leg, and a smaller tube the short leg of his syphon. The gas was lighted, and the tube which was connected with the chimney flue—the fire-place being closed—was laid upon the lip of the circular globe on the chandelier. On laying the hand upon the open space of the globe, it became apparent that the carbonic acid was being carried into the tube and up the chimney, although there was no fire on; and on placing a piece of tissue paper over the orifice of the globe, it merely curled, and had a tendency to go inside. So much for the reversed syphon. I regret I cannot spare more time over it; for, having used it in the form

* We suppose the author here refers to the Hon. H. Ruttan.—Ed.

of flues and otherwise, I am satisfied that it is the best simple extractor of air I have yet seen. Used in conjunction with Pierce's pneumatic fire-lump stove, the action I have found to be certain and continuous.

## PETROLEUM AS A FUEL FOR STEAMSHIPS.

Two very interesting papers were read at the Royal United Service Institution on Monday night by Captain Selwyn, R.N., and Mr. Richardson, upon the subject of petroleum as a fuel for steam ships. The Duke of Somerset occupied the chair, the theatre being thronged with gentlemen of position, who evinced considerable interest in the proceedings.

Captain Selwyn, in commencing his paper, adverted to the great facts attendant upon the introduction of petroleum into this country. It was not a discovery of modern years, as was erroneously supposed by many people, but had been well known for ages, and was quoted in the scriptures under the title of naphtha. Many ancient philosophers, including Pliny, mentioned it, and therefore it was by no means a new substance, though it had been preserved for the present age to utilise it to its full value. By some, petroleum had been supposed to be the produce of extinct collieries, and it was a fact that oil was obtained in this country in very large quantities from coal at a low red heat temperature. It would be vain to deplore the great waste that had been going on for some years past at the various pits by burning the small coal. If any one were to set fire to a forest he would be called a despoiler, yet the small coal burnt at the mouth of the pit was but a forest in another form, and contained a mine of wealth to the adventurous capitalist. It would be needless here to review the many undertakings by companies established for the purpose of distilling coal oil, but Mr. Young's patent having expired, a wide field was opened for those who sought to make large fortunes. There were many recommendations for coal oil, which was rich in colour, while petroleum was not so much so, and upon the score of safety if the volatile matter were driven off the crude oil, there would be no danger of any explosions. Leaving these general remarks, he (Captain Selwyn) would come at once to the subject of the present lecture—viz., the use of petroleum as a fuel for steamships. Now, the first question to be settled was "How many pounds of water could be evaporated by a given quantity of the fuel?" The next was as to the price of such fuel. It must be remembered that in all the experiments that had been made as yet the boiler used had been a tubular boiler, which was the worst of all kinds for procuring steam. Upon the capabilities of the oil, it had been declared that 58 gallons of the crude product were equal to one ton of coals. And in the experiments made to determine this, the apparatus used was expressly constructed to consume coal, and not oil. If all the points were fully considered, it would be found that the great waste experienced in burning coal made up in a great measure for the difference in price between it and oil. The lecturer was well aware that the idea of burning petroleum as a steam fuel had been ridiculed by many men of distinction upon the score mainly of cost; but the price of an article upon its introduction must not be taken by any means to estimate its ultimate cost. Let them remember that now a ship could only carry fuel for nine to thirteen days, and no ship could carry sufficient coal for a voyage to Australia or for a long blockade in time of war. Now, with petroleum a ship could carry fuel sufficient for forty to fifty days, and in naval warfare a great benefit and advantage would be derived from a fluid form of fuel, carried as it would be in a very small space. In addition to its occupying but little room, petroleum would be found to be highly preservative of iron, and as a fuel itself would not be nearly so much trouble as coal. The engine would not require so many stokers, and there would be no nuisance in getting up the ashes. Some people objected to the oil as a fuel on the score of danger, but all danger from crude was easily removable, and, indeed, it was not likely any danger would arise even if a red-hot shot were to touch the crude oil. A white vapour with an unpleasant smell would be thrown off, and unless flame touched this white vapour no explosion would ensue. The great drawback was the form of boiler that had been used, and a new boiler (under a new system) invented by Mr. Field, had been applied successfully to the land fire engines. There were advantages enough in the fluid fuel to warrant its use even at the present prices. Prices were quoted now £18 per ton crude, and £23 refined, but then the stowage room would make up for the difference, and the lighter portion of the oil could be used as an illuminative power in the same ship. With ordinary care there need be no danger, as the specific gravity was easily ascertainable by means of the hydrometer, and the specific gravity was the test of the dangerous properties of the evil. (The sample of oil on the table had extinguished a lighted match thrust into it.) The lecturer had received a letter from America giving an outline of some experiments made with oil under steam boilers; it was alleged that the saving would be $\frac{3}{10}$ths in bulk and $\frac{1}{4}$ths in cost in the voyage of a steamship from America to Liverpool. He expected to have the report soon, and while the company would take the assertions *cum grano salis*, yet they had been made by a gentleman of reliability and honour. The lecturer then concluded an able paper by showing the effect of Mr. Field's new boiler, and sat down amid applause.

Mr. Richardson said that in his paper he should follow closely in the wake of Captain Selwyn. He would remark that the best samples of the oil put out a lighted paper, and in its explosive qualities the vapour resembled common gas, but this vapour was so light that in a place well ventilated it would pass off without ignition. When petroleum was kept in iron cases no vapour could escape, and, therefore, no danger would arise. He (Mr. Richardson) would take the three distinctive properties of petroleum, and just describe them passingly. The first was the spirit, which is easily ignited, and was extensively used as a substitute for turpentine. The second was a burning oil in several varieties; and the last the thick oil, which did not vapourise unless at a very high temperature. The heavy petroleum neutralised the lighter kinds, and was extremely valuable as a steam fuel. [The lecturer here showed by diagrams the process of burning the oil and evaporating the lighter portions in an American engine, which he pronounced to be dangerous, and to require constant attention.] In making a grate for the consumption of the oil, it was necessary to have a porous substance, and it was found that the hard kinds burnt slowly, and the softer quickly, but the best substance of all was the petroleum coke, a sample of which he produced. [The lecturer again explained by means of the various diagrams the plan adopted for the prevention of the creation of too much vapour. The vapour chamber being placed at the top of the fuel succeeded better than in any other way.] Upon the occasion of the experiment he succeeded in getting up steam in 1½ hour, and full steam in another hour. All the crude oils (except Rangoon, which was too thick) burnt equally well in the grate; and upon the subject of the porous material he produced a piece of porous substance about four inches long, and as thick as a large rushlight, placed in a small jar of crude oil, leaving about half projecting. This being lighted, burnt well, and it was stated that immersed in a pint of the oil it would continue to burn until the oil was exhausted. Now the coal grate was 9 ft., to the oil grate's 2 ft. and the engineers did not think steam could have been got at the pressure possible. As regarded the experiments at Woolwich and Chelsea, the boilers used had been constructed for coal, and were not calculated for burning petroleum, and he (Mr. Richardson) foresaw that a boiler must be expressly made for petroleum, as it required a slower draught than coal. As to the advantages of petroleum in stowage, it might be stated as an example that in the *Great Eastern* steamship 2000 tons of oil would be quite equal to the 10,000 tons of coal now required. (Applause.) The objections as to price were easily settled. An English skipper was not likely to take Pennsylvania crude oil at £18 to £20 per ton when he could get English crude oil, quite as good, for £9 or £10; and as regarded the Royal Navy, such a quantity of the fluid fuel could be taken as stowage that coaling stations would be rendered unnecessary. If the waste in coal, difference in stowage, and labour were taken into consideration, it would be found that the advantages were immensely in favour of petroleum fuel; and the lecturer felt that a vital change would speedily take place in the mode of procuring steam for the ships of the navy and merchant service. (Great applause.)

The Duke of Somerset invited the company to put any questions they pleased to Captain Selwyn and Mr. Richardson.

Mr. Paul said that the alleged differences between coal and oil were so startling that proof was absolutely necessary. At present the only boilers in use were tubular, and before they were altered there must be very good reasons given that the new fuel would answer. (Applause.)

Mr. Wright confessed that he came into the room with many scruples, and the main portion had been entirely removed. Mr. Richardson was not too sanguine in his statements, and the extensive experiments made amply justified the outlay. (Applause.)

Mr Macintosh, who was listened to with some impatience, strongly argued against the probability of petroleum ever being used as a fuel for steamships.

Sir Edward Belcher was very much in favour of the new fuel, which he considered to possess great advantages over coal.

Mr. R. Mallet confessed himself a believer in the liquid fuel; and the time would come when every steamship would carry it. (Great applause.)

Captain O'Season inquired if the experiments at Woolwich had been carried out to the satisfaction of the Government authorities, and if petroleum was safe? If it were safe, then the Government need only establish one or two depôts to accomplish the circumnavigation of the globe. (Applause.)

Mr. Richardson considered petroleum to be quite safe, though a little dangerous if used foolishly. Those using it should make themselves acquainted with its properties.

Captain O'Season pointed out that it had been in the course of the lecture assimilated to gas; and it was well known that dangerous explosions occurred with gas.

Mr. Richardson said that if the vapour were allowed to escape in a close room, and a candle applied, an explosion would take place. As to the trial at Woolwich, the experiment was not quite successful, in consequence of the faulty nature of the apparatus supplied by the lecturer's engineer. In conclusion, he would remark that the gas from petroleum was four times as good as the gas from coal. (Applause.)

Captain Selwyn stated that there was more danger with coal than there was from petroleum.

The Duke of Somerset said he should look back with great pleasure upon the interesting lectures and discussions of the evening. The great questions for the public now were light and heat—cheap light and cheap heat (applause); but, as regarded petroleum as a fuel, he was not yet prepared to recommend a new boiler for the navy. We were not advanced enough for that at present; but looking at the great alterations which had taken place and were still taking place, in our steam navy, in a few years, no doubt, the fuel advocated so strongly and so ably this evening would be the fuel of the day. (Great applause.) When that time came, it would be a subject of congratulation to the able and talented lecturers of the evening that their labours had not been in vain. (Great applause.)

The proceedings then terminated.

## Useful Receipts.

### Polishing Paste.

1. Potash ½ lb., dissolve in a little boiling water, add soft soap 2 lbs., rotten stone 3 lbs., oil of thyme ½ oz., colcothar and emery of each ½ lb.; mix.

2. Boiling water 1 pint, oxalic acid 2 oz., soft soap and sweet oil of each ½ lb., rotten stone 4 lbs.; mix. Used to clean brass, tin, and other metals. The paste is laid on with a little water, and rubbed until the article is clean, it is then wiped off and the metal polished with powdered rotten stone.

### Pomatum.

It is made by covering lard with perfumed flowers, and changing them when exhausted, until the lard or pomatum is sufficiently scented.

**Coloured Flames.**

*Blue Flame.*

Nitre .................... 5 parts.
Sulphur ................ 2 parts.
Metallic Antimony ... 1 part. Mix together.

*Red Flame.*

Dried nitrate of strontia ......... 72 parts.
Sulphur ............................ 20 parts.
Gunpowder .......................... 6 parts.
Coal dust ............................ 2 parts. Mix.

*White Flame.*

Petroleum.

**Poison Antidote.**

Mr. J. Bruce has recently discovered a remedy for persons poisoned by strychnine and by mushrooms. It consists in making the patient eat large quantities of refined sugar, and in desperate cases opening a vein and injecting sugared water. Its effects are to oxygenate the blood and restore the circulation. He recommends its application to all venomous bites, and considers that it may be tried with much advantage, in "lockjaw and accidents from chloriform."—*Mechanics' Magazine.*

# Machinery and Manufactures.

## THE ECONOMICAL USE OF STEAM.

That the steam engine is still capable of vast improvement, no one will deny. The word "improvement," however, is very comprehensive, and therefore many changes in the construction and working of steam machinery which have nothing whatever to say to economy in the consumption of fuel, may be regarded as improvments in the fullest sense. Up to the present moment no means have been devised by which an engine may be built at a small expense capable of developing a high duty from the coal consumed on its grates, and thus we find that in certain districts economy of fuel, if it can only be secured at the expense of a considerable addition to the first cost of the machine, would hold out no advantages whatever. The fuel habitually used, for example, in the "Black Country," is slack, and this can—when the coal trade is in its normal condition—be delivered at very considerable distances from the pits at as low a price as two shillings and sixpence per ton. Including depreciation, the capital invested in steam machinery must be charged with at least ten per cent. annual interest, and under these conditions it follows that a very moderate increase upon the first cost rendered necessary by the adoption of any exceptional expedients, commonly classed as improvements, would completely neutralise every benefit to be derived from the saving in fuel. Where coal is scarce or dear, this rule of necessity no longer holds good, and thus, if we exclude the coal-producing districts of the world, we may regard it as fairly proved that the capital invested in first-class steam machinery will pay a far higher dividend than it would if expended in the purchase of inferior engines or boilers. It does not follow from this, however, that high-priced steam machinery is invariably the best; large sums are annually expended upon mere finish ; a point of detail, and a question of taste which really bears but a remote and uncertain connection with true excellence. So long as natural laws are obeyed, and a strict attention is paid to correct principles, it is a matter of small importance that a connecting rod or a crank shaft should be bright, or a fly-wheel or framing assume a form in accordance with individual ideas of beauty. True finish is to be found in places where the eye experiences no enjoyment from its presence, within the cylinder, valve chest, and bearings ; in the details of pistons and stuffing boxes ; and, provided it is to be found there, it is a matter of little consequence that it should be absent elsewhere. We do not wish it to be understood for a moment that we deprecate the expenditure of labour, time, or money on the impartation of mere beauty of outline and surface to mechanism ; but we do wish it to be understood that there is an existing and even growing tendency to pay very strict attention to such matters, while those upon which real excellence depends are comparatively or wholly neglected. It is not perhaps easy to account for this, but it is probable that the reason may be found in the fact that economical steam machinery is usually complicated and bulky, and, therefore, that unless fitted up with care it will ordinarily absorb a considerable annual sum in repairs. All our mechanical engineers are not blessed with talent ; manufacturers and employers of steam power seldom dip very deeply into questions of detail. Mere brilliancy of surface is easily to be had in these modern days of machine tools ; paint and varnish, and brass beads and moulded work, cost very little ; and thus it follows that a simple showy engine, strong and well finished in the popular sense of the term, can always and at all times command a far readier sale than unpretending machines which may, after all, be infinitely better. Even beauty costs money—not much perhaps, but still enough to tell upon the profits of the mechanical engineer ; and so long as prices must be kept down, it is not easy to see how both beauty and true excellence can be supplied to the public at the price which beauty alone commands. We trust that the day is not distant when the employer of steam power will perceive that it is desirable that he should secure something more for his money than even strength of parts and elegance of detail, and it is certain that the moment such an opinion becomes widely received, a new era will commence in the history of the steam engine.

Economy in the use of steam is by no means to be confounded with economy in its production. In point of fact, the proportions of a boiler, furnace, or stack bear no more relation to the engine which the boiler in question supplies with steam, than the hill from which a torrent descends, does to the water-wheel put in motion by the stream in the course of its career. Instances not a few may be found wherein the objects had in view in the construction of first-class boilers have been wholly defeated by bad engines. On the other hand, good and economical machinery will compensate for a thousand defects in a steam generator. The best possible result can of course only be obtained in cases where mutual excellence is to be found ; as a general rule, however, boilers are far better than engines. It is not indispensable that a boiler, to be economical, should also be dear; almost everything depends upon the skill and judgment of the designer; little or nothing upon pounds, shillings, and pence. Practically it is as cheap to set a boiler correctly as incorrectly. The shape and dimensions of a fire-box are never dictated by its cost. And thus it follows that the evaporation theoretically due to the consumption of every pound of coal is frequently nearly approached, while even ordinary boilers, very seldom depart widely from the results which ought to be obtained. At the best of times, however, steam is an expensive commodity; every cubic foot produced represents so much value, and therefore every possible precaution should be taken to realise the highest possible results from its use. Fortunately, however much variety may exist in the actual methods employed and intended to secure this end, only two great principles are involved, and if these receive due attention everything else follows as a matter of course.

The absolute energy developed by any steam engine is accurately represented by the amount of heat converted into work done. This bears no fixed relation to the number of units of heat produced in the furnace, or actually contained in the steam passing through the cylinder. In order that the question may be clearly comprehended, it must be understood that, in order that work may be done at all, a certain proportion of the heat which is contained in the steam must be given up, and transmuted as it were, into work. The practical result of this is, simply that a certain proportion of the steam is condensed or reconverted into water, independently of any frigorific influence whatever. Thus, if we suppose certain conditions to exist under which a cylinder shall be carefully preserved at the initial temperature of the entering steam, while radiation of every kind is absolutely suppressed, it will still follow that at every stroke of the piston a certain amount of heat will be expended —absolutely lost, in fact—in return for the work done by the piston. If the piston were absolutely devoid of weight and perfectly free to move, so that the steam would suffer no resistance during its course from one end of the cylinder to the other, then would this loss or transmutation not take place. In other words, the steam contained in the cylinder would at the end of the stroke possess precisely the same temperature which it had on its entrance. The greater the resistance to be overcome, on the other hand, the greater would be the loss; and this loss it must be understood, is wholly independent of, and bears no relation whatever to, any external or internal agencies which might tend to produce condensation. In other words, there are two methods, popularly speaking, by means of which steam may be reconverted into water. The first and most obvious of these is the application of cold; the second, and least known, or at all events least appreciated, is the performance of work. In reality however, by the application of cold the heat of steam is converted into work. There is no alternative. Power can neither be created nor yet annihilated. It can be changed into heat, or heat can in its turn be changed into power, but man is absolutely unable to further affect agencies which have existed since the creation of the world, and will endure to the end of time. Thus, when a certain quantity of steam is mixed with a given weight of cold water, condensation is effected. The heat previously contained in the steam partly remains as heat in the water, and is partly converted into work expended in expanding the condensing fluid, or driving its ultimate atoms farther apart. In this fact we find the only correct explanation of the phenomena of latent heat, an explanation, the credit of which is due we believe, to Mr. Isherwood, of the American Navy. The heat absorbed in the conversion of water into steam does not become latent; it absolutely ceases to have any existence as heat, being converted into work done in overcoming the atomic attraction of the water or other liquid of condensation and converting it into steam. The moment the atoms are permitted once more to coalesce, the work expended reappears in the form of heat communicated to the condensing water, or air, or cold iron, as the case may be.

We see from the foregoing that the proportion of power realised from a given weight of fuel through the agency of steam bears an exceedingly small ratio to the whole amount of power contained in the fuel, even under the best and most favourable conditions. In the very best engines it is impossible to render more than ten per cent. of the initial energy available for our purposes, while with inferior arrangements not more, possibly, than two per cent. can be realized. In order that all the power should be obtained it would be necessary that the steam should part with all its heat before leaving the cylinder—not, be it understood, by communicating it to the surrounding metallic surfaces, or by radiating it into the atmosphere or the condenser, because the conditions are paradoxical; we cannot suffer steam to part with all its heat and yet retain the cylinder at a high temperature; but it is perfectly possible to obtain a far higher return of power from the coal consumed than we habitually secure. Theoretically, less than ·5 of a pound of Newcastle coal burned per hour should give a horse power; practically, from six to twelve times this quantity is necessary; but by proper arrangements a mean between the two is sometimes reached without much difficulty, and that which has been done once can usually be done any number of times subsequently. Let it be remembered that steam is nothing more than energy in a tangible form—that it is simply the vehicle in which power may be conveyed from place to place; and that this power is freely communicated to everything with which the steam comes in contact, and we shall be at once placed in a position to understand how very difficult it is to devote all this power to the rotation of a fly-wheel and crank shaft against a given resistance. In the first place, there is the metal of the cylinder to be heated; this in itself implies the expenditure of considerable energy. The expansion of the metals absorbs an amount of power represented directly by their tensile strengths. Thus a bar of iron, in expanding under the influence of heat, will easily break itself. The air in contact with the heated portions of the machinery absorbs another fraction of the gross power in its expansion. Every drop of water evaporated in the cylinder at the expense of the entering steam absorbs power. It is needless to proceed with a mere catalogue of agencies which will at once become apparent to our readers on reflection, and it is not too much to say that in no branch of his profession has the mechanical engineer better opportunities for displaying his talents and acquirements than in combating these agencies and obviating their injurious effects. After all has been done, it is somewhat humiliating to find that such a very small percentage of power only can be preserved for our own specific purposes.—*Mechanics' Magazine.*

## GALVANIZING IRON.

Ure, in the supplement to his dictionary, gives the various processes of galvanizing as follows:—

In 1837, Mr. H. W. Crawfurd patented a process for zincing iron. In the "Repertory of Patent Inventions," his process is thus described:—Sheet-iron, iron castings, and various other objects in iron, are cleaned and scoured by immersion in a bath of water acidulated with sulphuric acid, heated in a leaden vessel, or used cold in one of wood, just to remove the oxide. They are then thrown into cold water, and taken out one at a time to be scoured with sand and water with a piece of cork, or more usually with a piece of the husk of the cocoanut, the ends of the fibres of which serve as a brush, and the plates are afterwards thrown into cold water.

Pure zinc covered with a thick layer of sal ammoniac is then melted in a bath, and the iron, if in sheets, is dipped several sheets at a time in a cradle or grating. The sheets are slowly raised to allow the superfluous zinc to drain off, and are thrown whilst hot into cold water, on removal from which they only require to be wiped dry.

Thick pieces are heated, before immersion, in a reverberatory furnace, to avoid cooling the zinc. Chains are similarly treated, and on removal from the zinc require to be shaken until cold, to avoid the links being soldered together. Nails and small articles are dipped in muriatic acid, and dried in a reverberatory furnace, and then thrown all together in the zinc, covered with the sal ammoniac, left for one minute, and taken out slowly with an iron skimmer. They come out in a mass, soldered together, and for their separation are afterwards placed in a crucible and surrounded with charcoal powder, then heated to redness and shaken about until cold, for their separation. Wire is reeled through the zinc, into which it is compelled to dip by a fork or other contrivance. It will be understood that the zinc is melted with a thick coat of sal ammoniac to prevent the loss of zinc by oxidation.

Mr. Mallett coated iron with zinc by the following process;—The plates are immersed in a cleansing bath of equal parts of sulphuric or muriatic acid and water, used warm; the works are then hammered and scrubbed with emery and sand to detach the scales, and to thoroughly clean them; they are then immersed in a "preparing bath" of equal parts of saturated solutions of muriate of zinc and sal ammoniac, from which the works are transferred to a fluid metallic bath, consisting of 202 parts of mercury and 1,292 parts of zinc, both by weight, to every tun weight of which alloy is added above one pound of either potassium or sodium, the latter being preferred. As soon as the cleaned iron works have attained the melting heat of the triple alloy, they are removed, having become thoroughly coated with zinc. At the proper fusing temperature of this alloy, which is about 680° Fah., it will dissolve a plate of wrought-iron of an eighth of an inch thick in a few seconds.

Morewood and Rogers's galvanized tinned iron is prepared under several patents. Their process is as follows:—The sheets are pickled, scoured and cleaned just the same as for ordinary tinning. A large wooden bath is then half filled with a dilute solution in muriate of tin, prepared by dissolving metallic tin in concentrated muriatic acid, which requires a period of two or three days. Two quarts of the saturated solution are added to 300 or 400 gallons of the water contained in the bath. Over the bottom of the bath is first spread a thin layer of finely-granulated zinc, then a cleaned iron plate, and so on, a layer of granulated zinc and a cleaned iron plate alternately, until the bath is full. The zinc and iron, together with the fluid, constitute a weak galvanic battery, and the tin is deposited from the solution so as to coat the iron with a dull and uniform layer of metallic tin in about two hours. The tinned iron is then passed through a bath containing fluid zinc, covered with sal ammoniac mixed with earthy matter, to lessen the volatilization of the sal ammoniac, which becomes as fluid as treacle. Two iron rollers immersed below the surface of the zinc, are fixed to the bath and are driven by machinery to carry the plates through the fluid metal at any velocity previously determined. The plates are received one by one from the tinning bath, drained for a short time, and passed at once, whilst still wet, by means of the rollers, through the bath as described. The plates take up a very regular and smooth layer of zinc, which, owing to the presence of the tin beneath, assumes its natural crystalline character, giving the plates an appearance resembling that known as the *moiree metallique.*

It is stated that galvanized iron plates, cut with shears so as to expose the central iron, become zinced round the edges, and at the holes where the nails were driven. We are also informed that *ungalvanized iron* will, if moist when near galvanized plate, become zinced, and that telegraph wires, where cut through, become coated by the action of the rain water on the galvanized portion of the surfaces.

It has been stated that the galvanized iron is not more durable than unprotected iron; that, indeed, where the zinc is by any accident removed, the destruction is more rapid than ordinary. We have made especial inquiries, and find that in forges where there is any escape of sulphur vapor the galvanized iron does not stand well, but that under all ordinary circumstances it has the merit of great durability in addition to its other good qualities.

## MANIPULATION OF METALS.

There are many occasions where a knowledge of some simple alloy or a peculiar solder would save hundreds, yes, thousands of dollars, just as a life may be saved by merely tying a pocket handkerchief tightly above a bleeding artery. It is only a few years ago that the valve-stem on the engine that runs the *Herald* presses broke in the dead of night, when but half the edition was run off. This was a dilemma, indeed, for a valve-stem is not made in half an hour, neither can it be bought at a hardware store like a pound of nails. The engine was injured in a vital part, and unless it was mended the entire edition would be stopped and incalculable loss sustained. Fortunately for the proprietors there was one of the employés present who understood the manipulation of metals, and he informed the bystanders that if they would collect their spare silver he would restore the broken part to a condition of usefulness.

It was done.

The stem was brazed with silver solder, and the engine performed until morning, so that the whole edition was successfully run off. But for the presence of the adept referred to, and his knowledge of this simple process, very great loss would have been incurred.

Some of our readers may be caught in just such a predicament, and we therefore append a formula for a solder which will braze steel. It is as follows:—Silver 19 parts; copper 1 part; brass 2 parts; if practicable charcoal dust should be strewed over the melted metal in the crucible.

A good article of yellow brass is extremely desirable for fine work in telescopes and optical instruments generally. A metal that works true and soft under the tool, and is capable of receiving a fair luster from the burnisher, is always in request. A good yellow brass can be made from the following metals:—That denominated "watchmaker's brass" is made of one part copper and two parts zinc. German brass is equal parts of copper and zinc; the addition of a little lead makes the metal work easier and less liable to tear under the tool.

In all these mixtures the zinc must be added last as it is a volatile metal and fuses at a much lower heat than the copper; the melting point of which is 4587 degrees, while that of the zinc is only 700 degrees.

Iron and brass must be united by spelter, which is equal parts of brass and zinc. When the joints are cleaned and wired together fine powdered borax is applied to them as a flux. The solder is then dusted on in the form of a powder, or fine filings, and melted in, either with a blow-pipe or by being placed in a charcoal fire. Care must be taken not to melt the brass to be brazed. The solder of course has a much lower fusion point than the metals to be joined, else they would both run at the same time.

A simple method of case-hardening small cast iron work is to make a mixture of equal parts of pulverized prussiate of potash, saltpetre and sal ammoniac. The articles must be heated to a dull red, then rolled in this powder, and afterwards plunged into a bath of 4 ounces of sal ammoniac and 2 ounces of the prussiate of potash dissolved in a gallon of water.

These simple rules are practical and will give good results with good workmanship. If the cast iron is overheated and burned, the unskillful workman must not blame the formula for his failure; or if he put on such a blast as to blow the solder out of the joints, when brazing, and instead of making a joint spoils the job, he must not charge it upon us, but keep a brighter look-out in future. Good rules are useless unless put in force and practiced with skill and intelligence.—*Scientific American.*

## AN ENGLISH LARD FACTORY.

We will take our readers on a tour through the extensive manufactory belonging to Messrs. Shaw, Phillips & Billings, situate on the banks of the Avon, about two miles from Bristol, England—the metropolis of the west. Messrs. Shaw, Phillips & Billings, own one of the oldest and most extensive soap manufactories in the kingdom, and although it is but eighteen months or so since they added to this business of lard refining, they have during that short period, imported the raw material from America at the rate of 1,000 tuns per annum, in addition to the supplies received from some of the home markets. Taking this 1,000 tuns as a basis for calculation, it would produce, say, about 700 tuns of the finest refined lard, in addition to about 250 of the lard oil, and certain refuse substances, which are turned to profitable account in the soap manufactory. Through the yard to the refinery we are accompanied by Mr. Phillips, one of the partners. The head is first knocked out of a tierce of the crude material, the produce of Indiana and neighboring States, where the renowned hog-slaughtering cities of Chicago and Cincinnati collect and distribute to all quarters of the globe pigs, pork, lard, and bladders. The lard used by Messrs. Shaw, Phillips & Billings is imported in tierces and barrels from New York, the supply to that market from the pork-packing neighborhoods having been very plentiful of late, on account of the great increase in the crops of Indian corn, upon which the pigs are mostly fed.

### How Lard Oil is made.

But let us commence operations. Woollen bags, close grained and manufactured for the purpose, are filled with the crude lard, taken from the tierce which has been opened for our inspection. A series of these bags are placed between the plates of immense hydraulic presses, where they remain about eighteen hours, under a pressure of from 100 to 150 tuns. By this means the lard oil is expressed in so pure a state that if a drop be taken on the tip of the finger, and held up to the light, it glistens like a diamond. The oil as it is pressed out is caught in a reservoir below, and from this it drains through a pipe into an immense cistern beneath the floor. Having once ascertained this interesting fact, the desire to "pass on" became stronger and stronger as the thoughts of the possibility of dropping through the ricketty boards into the oily lake became more prominent to our mental vision. We wait, however, while a small phial is filled with a sample of the oil, which our guide considers it incumbent upon us to taste, in order to realize fully its good qualities as a lubricating agent. We next inspect the contents of one of the bags which has already undergone the necessary pressure, and find that it has not only assumed a more solid form, but has improved in color. Mr. Phillips having cut from the cake of compressed lard a square piece to carry with him for the purpose of comparison, we again join him in the enjoyment (?) of another little relish, and proceed on our way, marshalled by our guide, who carries like a trophy on the point of a stout jack-knife the snowy specimen.

Before finally quitting this department we are desirous of ascertaining what becomes of the oil which we have already seen dripping into the underground reservoir. A force pump raises it into pipes, through which it is conducted into a refining tank, and thence into a series of immense iron cisterns enclosed in a dark cavern-like chamber, heated with steam flues, and kept winter and summer, day and night, at an even temperature. One of these tanks holds twelve tuns of oil, and the others about five tuns each. The contents after remaining under the influence of the regulated temperature, without being disturbed, for a certain time, are freed from any impurities that may remain before being sent on to the market.

#### How the Cakes are reduced to Lard.

When all oil that it is possible to extract from the lard has been expressed, the remaining cakes are taken from the woolen cloths and thrown into a cistern, where they are liquified at a temperature of 150°, and transferred from this by means of pipes to the room which we shall now describe. In the center is a range of immense pans, each heated by a steam chamber, reaching about half way up the outside. Over each pan is a tap, from which supplies of the liquid lard are drawn. The pans thus filled, and the necessary clarifying agents added, all is simmered together for six hours, at a heat of 210°. The impurities, with the clarifying agents, come to the surface in the form of a rough brown mass; and if, good reader, you were to mount the brick wall and look into one of the coppers under the idea that you might see lard, you would be disappointed, unless, as in the case with us, some kind friend with a long stick were to probe the mass and extract a specimen from beneath. This, however, is not the usual means taken to release the pure material from the dross; it is drawn off in large tin vessels by means of taps placed near the bottom of each boiler.

#### How the Lard is Solidified.

Two large coppers, built on the floor at either end of the room, are filled with the liquid as we have just seen it. An air-pipe, two inches in diameter, enters the mass right in the center, and keeps the lard in a state of incessant agitation until it begins to congeal, the process generally occupying about two hours. The air, permeating through every particle of the mass, renders it impalpably smooth and increases its whiteness. While still in a semi-liquid state, the copper is surrounded by men and boys. One lad hands up the bladder ready for filling; the stem of a funnel is inserted in the neck of the same; and before you can say "presto," it assumes that rotundity and snowy baldness so familiar to us all. The bladder is tied while floating in a tub of luke-warm water, and then popped, with extraordinary agility, by another boy into a vessel containing cold water, where a short time suffices to harden it. All around this apartment are ranged wide shelves groaning under the weight of the plump, chaste, though irregular-shaped balls. An immense stock of neat little kegs of the usual size, filled and fastened down ready for transmission to our retail provision stores, occupy one side of the apartment, and beside them a range of tins all filled in the same manner, but uncovered. The kegs, we are informed, are made in Liverpool, a town long celebrated for its coopers. Though Bristol can boast of many such craftsmen, it seems that lard and other small kegs cannot be made there at prices that will compete with the Liverpool terms, although carriage has to be paid from the latter place.

#### Concerning the Bladder Department.

It is truly refreshing to leave behind us the warm oily atmosphere of the clarifying-room for that of another large apartment, well ventilated with lattice work on each of its broad sides. Let the reader now imagine an enormous overgrown sideboard of the whitest deal, on the broad shelves of which are ranged, waiting for despatch, more ready filled bladders. Looking up, we begin to think we have wandered into the abode of an itinerant vendor of children's farthing balloons, which are suspended in bundles, and sway to and fro in the breeze. We are informed, however, that these are the lard bladders undergoing the necessary preparation to render them fit for commercial purposes. The manager of this particular department now undertakes to put us through the mysteries of bladderology. A very communicative and obliging person is our new guide. He shows us countless barrels of bladders in pickle—grizzly uninteresting-looking things—as they come from the United States. Each barrel is marked with the number it contains, which is almost invariably either 2,000 or 2,300. The head of an empty barrel placed under what we would at first glance judge to be a wine merchant's bottling tap, serves as a work table for the operator. The bladders, softened to the proper consistency, are distended by a supply of air from this tap, which has proved a wonderful saving to the lungs of the manager and his subordinates. It appears that in all establishments of this kind the bladders, in order to be trimmed and bleached, are blown up by the workmen. The effect of the constant expulsion of wind on the operators is sometimes of a serious character, and workmen are frequently obliged to remain at home for a week or two to "gather wind." It occurred, however, to a member of this firm, that by means of a tap they could make use of the compressed air already forced by steam power into the pipes, for purposes which we described, to fill the bladders also. This simple idea has been adopted, and with such good effect that, while much time and intoxication are saved, the bladders are more perfectly blown, and are, in consequence, easier to trim. Our instructor submits one or two sample bladders to the action of the air-tap, by which we are able to judge that calves' bladders, more than any others, are fond of assuming contorted forms when filled. Pigs' bladders are the largest produced, and run in more uniform sizes than others. We were shown some capable of containing 60 lbs. of lard. Bullocks' bladders are more shapely than any others, and on an average will contain 25 lbs.; but in all cases, the smaller the bladder the better for the preservation of the contents; hence small bladders, when filled, command a higher price in the market than large ones.—*Scientific American.*

## MAKE YOUR OWN NEAT'S FOOT OIL.

A correspondent of the *Germantown Telegraph* tells what they do with beeves' legs in his family

"The hoofs are chopped off, and the other portions are cracked and boiled thoroughly. From the surface of this boiled mass, about one pint of pure *neats-foot oil* is skimmed, which is unsurpassed by any other oleaginous matter for harness, shoes, &c. After the oil is taken off, the water is strained to separate from it any fatty particles that may remain, and then it is boiled again, until upon trying it, it is found that it will settle into a stiff jelly. It is then poured into flat-bottomed dishes, and when cold cut into suitable sized pieces. It hardens in a few days, and you will then have a very fine article of *glue*, free from impurities of every kind, sufficient for family use for a twelvemonth.

"By taking a portion of this glutinous substance before it becomes too thick, and brushing it over pieces of silk, you will have just as much *court-plaster* as you desire, inodorous, tenacious, and entirely free from those poisonous qualities which cause (as much of the article sold by apothecaries does) inflammation, when applied to scratches, cuts, and sores."

## ELECTRO-PLATING.

An ounce and a half of silver will give to a surface a foot square a coating as thick as common writing-paper; and since silver is worth 5s. stg. per ounce, the value of silver a foot square would be about 7s. 6d. At this rate a well plated tea-pot or coffee-pot is plated at a cost in silver of not more than 7s. to 8s. The other expenses, including labour, would hardly be more than half that amount. Electro-gilding is done in like manner. The gold is dissolved in nitric-hydrochloric acid, washed with boiling nitric acid, and then digested with calcined magnesia. The gold is deposited in the form of an oxide, which, after being washed in boiling nitric acid, is dissolved in cyanide of potassium, in which solution the articles to be plated with gold, after due preparation, are placed. Iron, steel, lead, and some other metals that do not readily receive the gold deposit require to be first slightly plated with copper. The positive plate of the battery must be of gold, the other plate of iron or copper. The popular notion is, that genuine electro-gilding must necessarily add a good deal to the cost of the article plated. This is erroneous. A silver thimble may be handsomely plated, so as to have the appearance of being all gold for 3d., a pencil-case for 10d., and a watch case for 4s. An estimate of the relative value of electro-gilding, as compared with silver-plating, as to cost of material, is about 15 to 1. The quantity of silver used in plating a large quantity of common ware, is about 1oz. to the square mile—one hard cleaning exposes the *base* metal.

## HOME MANUFACTURES IN IRELAND.

It is observed by the editor of the *Waterford News* that the greatest benefactors are those who give employment to our people. Charity is good in its way, but we feel convinced that work, to those who can work, is far better than charity. How sad it is to behold hale young persons, especially, eating the bread of idleness. No country can be prosperous that solely depends on agriculture, on which the weather has so much influence. To render employment general there should be occupation for all, females as well as males. We were, therefore, much pleased this week at paying a visit to the extensive establishment of a truly energetic fellow-citizen, Mr. Thomas Browne, in John's-lane, in this city, where we observed a large number of persons, chiefly females, employed in preparing the raw material for manufacturing paper, flannel, fine cloths, &c., &c. Here is a 12 horse-power engine, incessantly driving machines which manufacture delicate white wool out of old scraps of flannel, and extracting what is termed "shoddy" from old woollen rags, for which there is an enormous demand in the English manufacturing districts, in one of which alone there are no less than 100,000 persons employed. Mr. Browne has a new boiler which cost £130, ready to supplement the present one. Here, too, are vast piles of rags, of various kinds and colours, imported from England, Wales, Cork, Belfast, Limerick, and elsewhere, all intended to pass through his machinery, afterwards to be shipped to England, where they will be converted into various fabrics, including paper for the grocer, the lawyer and the newspaper, on which will yet be printed the burning language of the orator and the statesman; the reports of battles and of sieges, and the crushing articles which make tyrants tremble. The *Times* recently said that rags are the best of all products from which paper can be made. Here, too, are vast heaps of bones and scrap-iron, for transmission across channel, where the former will be converted into high-priced manure, oil, grease or acids; the latter to be re-cast into solid iron again, perhaps to be re-shipped to Ireland. The great loss to our country is, that we do not manufacture this raw material at home, by which so much employment would be extended. [How applicable this last remark is to Canada, Ed.]

## SHEEP SKINS FOR MATS.

Steep the skins in water, and wash them well till they are soft and clean; they are then scraped and thinned on the flesh side with the fleshing knife, and laid in fermented bran for a few days, after which they are taken out and washed; a solution of salt and alum is then made, and the flesh side repeatedly and well rubbed with it, until it appears well bleached; after which make a paste to the consistency of honey, of the alum and salt solution, by adding wheaten flour and the yolks of eggs, and spread this paste on the flesh side; after this they are stretched and dried, and when dry, rubbed with pumice stone.

## SHODDY LEATHER.

We have seen, within a few days, some specimens of a fabric which we presume is no novelty to our friends in the shoe trade, but which was entirely new to us. This fabric is a manufacture from refuse scraps of leather, which are reduced to a pulp by grinding and maceration, and re-converted into solid "sides" of leather, by pressure. The article thus produced is used mainly, we understand, for inner soles, but to an unprofessional eye it seems as suitable for all the purposes of leather as the original article.—*Salem Gazette.*

## HARDENING AND TEMPERING STEEL.

Steel is hardened by being heated a bright cherry-red, and plunged into cold water. The brittleness and hardness are then modified by gradually warming the metal, either over a fire, or by placing it on a hot metal plate, or in an oven, or in an oil bath. Some large manufacturers of cutlery use a tempering oven, the temperature of which is regulated by a thermometer. This saves a great deal of high-priced labor, and secures a uniform result. The following degrees of temperature and corresponding colors of the steel, for different purposes, are given in many books:—

| | Corresponding Temperature. | |
|---|---|---|
| A very pale straw | 430° | Lancets } |
| Straw | 450° | Razors } |
| Darker Straw | 470° | Penknives } All kinds of wood tools |
| Yellow | 490° | Scissors } Screw taps. |
| Brown Yellow | 500° | } Hatchets, Chipping Chisels, Saws. |
| Slightly tinged purple | 520° | } |
| Purple | 530° | } All kinds percussive tools |
| Dark Purple | 550° | } Springs. |
| Blue | 570° | } |
| Dark blue | 600° | Soft, for saws. |

—*Scientific American.*

# Practical Memoranda.

### Weight of Water in Pipes.

TABLE, *showing how to discover the Quantity and Weight of Water in Pipes of any given size.*

| Diameter in inches. | Quantity in cubic inches. | Quantity in imperial gallons. | Weight in lbs. avoirdupois. |
|---|---|---|---|
| ½ | 14·14 | 0·051 | 0·51 |
| 1 | 56·55 | 0·205 | 2·05 |
| 1½ | 127·23 | 0·460 | 4·60 |
| 2 | 226·19 | 0·818 | 8·18 |
| 2½ | 353·43 | 1·278 | 12·78 |
| 3 | 508·94 | 1·841 | 18·41 |
| 3½ | 692·72 | 2·506 | 25·06 |
| 4 | 904·78 | 3·272 | 32·72 |
| 4½ | 1145·11 | 4·142 | 41·42 |
| 5 | 1413·72 | 5·113 | 51·13 |
| 5½ | 1710·60 | 6·187 | 61·87 |
| 6 | 2035·75 | 7·363 | 73·63 |
| 6½ | 2389·18 | 8·641 | 86·41 |
| 7 | 2770·88 | 10·022 | 100·22 |
| 7½ | 3180·86 | 11·505 | 115·05 |
| 8 | 3619·11 | 13·090 | 130·90 |
| 8½ | 4085·64 | 14·777 | 147·77 |
| 9 | 4580·44 | 16·567 | 165·67 |
| 9½ | 5103·52 | 18·459 | 184·59 |
| 10 | 5654·87 | 20·453 | 204·53 |
| 10½ | 6234·49 | 22·550 | 225·50 |
| 11 | 6842·39 | 24·748 | 247·48 |
| 11½ | 7478·56 | 27·049 | 270·49 |
| 12 | 8143·01 | 29·452 | 294·52 |

This table shows the quantity and weight of water contained in one fathom of length of pipes of different bores from 1 inch to 12 inches in diameter, advancing by half inch. The weight of a cubic foot of water is taken at 1000 ounces avoirdupois, and the imperial gallon at 10 lbs.

*Temperature and Weight of the Atmosphere at various heights.*

| Height. | Temp. | Water heavier than the air. |
|---|---|---|
| Level of the sea, | 60° | 860 times. |
| One mile above, | 43 | 1,083 " |
| Two miles above, | 26 | 1,363 " |
| Three miles above, | 9 | 1,716 " |
| Four miles above, | -8 | 2,160 " |
| Five miles above, | -25 | 7,219 " |

### Centre,

In a general sense, denotes a point equally remote from the extremes of a line, surface, or solid.

*Centre of Attraction*

Of a body, is that point into which if all its matter is collected, its action upon any remote particle would still be the same.

*Centre of Equilibrium*

Is the same, in respect to bodies immersed in a fluid, as the centre of gravity is to bodies in free space.

*Centre of Friction*

Is that point in the base of a body on which it revolves, into which if the whole surface of the base and the mass of the body were collected, and made to revolve about the centre of the base of the given body, the angular velocity destroyed by its friction would be equal to the angular velocity destroyed in the given body by its friction in the same time.

*Centre of Gravity*

Of any body, or system of bodies, is that point upon which the body, or system of bodies, acted upon only by the force of gravity, will balance itself in all positions; hence it follows, that, if a line or plane, passing through the centre of gravity, be supported, the body or system will be also supported.

*Centre of Gyration*

Is that point into which, if the whole mass were collected, a given force, applied at a given distance, would produce the same angular velocity in the same time as if the bodies were disposed at their respective distances.

This point differs from the *Centre of Oscillation.* only in this, that, in the latter case, the motion is produced by the gravity of the body; but, in the former, the body is put in motion by some other force, acting at one place only.

### Cohesion.

Is that species of attraction which, uniting particle to particle, retains together the component parts of the same mass; being thus distinguished from *Adhesion,* or that species of attraction which takes place between the surfaces of similar or dissimilar bodies. The absolute cohesion of solids is measured by the force necessary to pull them asunder. Thus, if a rod of iron be suspended in a vertical position, having weight attached to its lower extremity till the rod breaks, the whole weight attached to the rod, at the time of fracture, will be the measure of its cohesive force, or absoute cohesion.

The particles of solid bodies, in their natural state, are arranged in such a manner, that they are in equilibrium in respect to the forces which operate on them; therefore, when any new force is applied, it is evident that the equilibrium will be destroyed, and that the particles will move among themselves till it be restored. When the new force is applied to pull the body asunder, the body becomes longer in the direction of the force, which is called the *extension;* and its area, at right angles to the direction of the force, contracts. When the force is applied to compress the body, it becomes shorter in the direction of the force, which is called the *compression;* and the area of its section, at right angles to the force, expands. In either case, a part of the heat, or any fluid that occupies the pores or interstices of the body, before the new force was made to act upon it, will be expelled.

### The Velocity of Sound.

It has been ascertained, by careful investigation, that sound passes in water at a speed of 4,708 feet per second.

# Photography.

## PHOTOGRAPHY.

[From the 'Quarterly Review.']

### Importance of the Art.

Of all the marvellous discoveries which have marked the last hundred years, photography is entitled in many respects to take its rank among the most remarkable. It will not produce the same wide-spread effects upon the social condition of the human race that have been and will be the result of the steam-engine and the electric telegraph. It will not bring any such mitigation to human suffering as has been caused by the discovery of chloroform. But it occupies a position distinct from these in the perfect novelty of its results, and their more direct connexion with the world of mind. It is not merely an improved mode of doing that which was done before. Carriages were drawn, and shuttles thrown, and signals sent from distant points, before ever Watt or Wheatstone was heard of. But the work which Wedgwood and Boulton are supposed to have begun, and which Talbot and Archer perfected, has done a new thing. It has forced the sun, which reveals to our senses every object around us, to write down his record in enduring characters, so that those who are far away or those who are yet unborn may read it. It has furnished to mankind a new kind of vision that can penetrate into the distant or the past—a retina as faithful as that of the natural eye, but whose impressions do perish with the wave of light that gave them birth. Photographs, regarded as evidence of that which they represent, differ in essence from any other species of representation that has ever been attempted. They are free, so far as their outlines are concerned, from the deceptive and therefore vitiating element of human agency. The work of the artist may be more beautiful, but it can never be so exact. Philosophers have pleased themselves with the fancy that the scenes that passed upon this earth thousands of years ago have not really perished; but that the waves of light which left the earth then are still vibrating in the illimitable distances of space, and might even now be striking, in some far-off fixed star, an eye sensitive enough to discern them. Supposing that photographs are preserved with reasonable care, the philosophic dream may be a reality to our remote posterity. Lord Macaulay's New Zealander, when he goes home from his perilous exploration of Great Britain, may gaze in some Antipodean museum upon a picture of the entry of the Princess Alexandra into London, traced not by some careless or courtly human hand, but by the very rays of light which were reflected from her face, and from the various persons and objects around her.

### The Wide Extent of the Art.

There is scarcely a family of any class in the United Kingdom in which the likeness of well-loved features, guaranteed by the infallible sun, is not duly prized; and the enormous demand has created a corresponding supply. There is scarcely any educated lady, fashionable or unfashionable, whose table is not adorned with the album of *cartes de visite,* containing a full allowance of royalties, half-a-dozen leading statesmen, and a goodly row of particular friends—all highly useful in furnishing subjects of conversation to guests "gravelled for lack of matter." There is hardly a cottage in which a humble sixpenny "positive" do not recall, somewhat duskily perhaps, but still truthfully, the lineaments of some distant son or brother. To meet his demand a whole army of professional photographers has sprung into existence, working with very various skill and in very different social positions—from the few celebrated artists in the great capitals, one or two of whom are said to be in the receipt of incomes far exceeding that of the Archbishop of Canterbury, down to the travelling photographer in a covered cart, who may be found in the remotest villages of Scotland or Cornwall, and whose gains may probably be described in the most modest possible terms. By the side of this professional class has arisen, not so widely of course, but still with remarkable rapidity, a very zealous body of amateur artists. A number of photographic societies exist, composed in some cases of amateurs and professionals conjointly, in others entirely of amateurs. The chief of these societies is honoured by the presidency of no less a personage than the Lord Chief Baron of the Exchequer; on the committee of another figures the name of the Primate of England; and the other less learned professions are not less fully represented. Three or four photographic newspapers, conducted for the most part with great ability, complete what may be called the social apparatus of the art.

**Its Application to Legal Purposes.**

In judicial inquiries, not less than in scientific experiments or investigations, its incorruptible and infallible accuracy gives to its production a value to which no work of human pen or pencil can even distantly approach. Governments have not failed to make use of it for purposes of criminal police. In some countries every person convicted of any crime is photographed, and the record of his features, duly multiplied, becomes part of the archives of every prison. Of course a hardened criminal, knowing the purpose for which his likeness is being taken, is not a very manageable sitter. But no choice is given to him: the room in which he is brought before the chief authority of the prison is so arranged that he is obliged to stand in a place where a good light falls upon him; and while he is being professedly examined, the concealed photographer does his work. The system has been introduced to some extent into England, but only very partially. It is to be regretted that the adoption of it has not been more general. The cost is quite trivial; and there is no other plan approaching to it in efficiency, for drawing that clear and certain line between new and old offenders which is absolutely essential to a sound criminal system. If every prison were armed with its photographic album, containing a pleasing collection of all the physiognomies which had ever been shorn of their flowing locks in any jail in the country, a ruffian out upon his third ticket-of-leave would not be able, as now, by the simple expedient of changing the field of his operations after every fresh conviction, to persuade the magistrates that he was an innocent, accidently led away by drink. The plan has received the sanction of the Committee of the House of Lords upon Prison Discipline, which was presided over by Lord Caernarvon, and under the auspices of the same noble Lord has been introduced into Winchester Jail. It can never attain to its full utility until it has been universally adopted; and therefor, it is to be hoped that the magistrates of those counties which have not yet adopted it may be induced to do so by the recommendations of the Committee of the House of Lords.

But this not the only service which photography is capable of rendering to the law. If Müller had never in an evil hour entered a photographer's studio, the link would have been wanting which so immediately connected him with the foreigner who entered Mr. Death's shop—pursuit might possibly have been delayed until it was too late—and he might have been by this time distinguishing himself as a rising Federal officer under the command of General Butler. An amusing instance of a similar kind, though in connexion with a less atrocious crime, occurred the other day. A thief bethought himself that it would be a good speculation in his way of business to steal one of a photographer's lenses, a kind of booty which would pay as well as a couple of dozen spoons. Accordingly, he went in to have his portrait taken, duly sat for it; and when the photographer retired to develope the plate, he walked off with his plunder in his pocket. Unluckily he had not reflected upon the consequence of the few seconds he bad spent in front of the lens he coveted. The photographer had obtained a good likeness of him, and the means of identifying him were, of course, speedily placed in the hands of the police. An incident of the same kind plays an important part in the drama of the 'Octaroon,' which was so popular in London two or three years ago. The author, however, shows the popular ignorance upon the details of photographic manipulation. The culprit is detected in consequence of his accidentally committing his crime in front of a camera and lens, which a photographer had accidentally left there. The author apparently entertained the view that in all places and under all circumstances a camera and lens would take the picture of what passed before them, without the intervention of any sort of human agency.

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**Its Application to Science.**

It is to science, however, that photography, the child of science, renders, and will unceasingly render, the most valuable aid. There is scarcely one in the whole list of sciences which is not largely indebted to it. Astronomy and microscopic observations have benefited singularly from the increased accuracy that has been secured. It is a boon of enormous value to be able in any instance to eliminate that fruitful source of error, the fallibility of the observer. Photography is never imaginative, and is never in any danger of arranging its records by the light of a preconceived theory. An instance of its utility in this respect was afforded by the great eclipse which took place some years ago. Much doubt existed as to the exact form of the curious protuberances which seem to shoot out from the sun's edge during the progress of an eclipse, and some controversy had even taken place as to whether they were not optical delusions. Such difficulties were easily adjusted by the production of an image of the protuberances in question upon a sensitive plate. In this case the use of photography is merely to correct the hasty inference which astronomers on the spot might form from an observation necessarily rapid, and taken under exciting circumstances. Its utility is still more conspicous in the far more numerous cases where the observer and the scientific reasoner are different persons. Hitherto the man of science, in many departments, has been at the mercy of the unscientific traveller. The ethnologist, the historian, the antiquarian, and often the geologist have to form their theories upon data which have been gathered by a gleaner whose appreciation of the value of minute accuracy may be inadequate. It is seldom that the qualifications necessary for the successful traveller and the successful student combine in the same person. From time to time such a man as Alexander von Humboldt arises, but he is a phenomenon to be wondered at, not to be counted on. Usually the enterprising traveller is too eager, too self-confident, and too little qualified by intellectual labour to extract the best results from the observations he collects. His drawings are passed on to some scientific man at home, who makes out of them what result he can; but the traveller is pretty certain to have a theory of his own, and that theory haunts him through all his observations. It guides him in the selection of subjects which he will undertake the labour of designing, and it perches on the end of his pencil when he is at work. If a man believes that the leaves of the sacred tree in Thibet do bear alphabetical characters, his drawing will not fail to convey that belief to his distant readers somewhat more emphatically than the original. If he has a view of his own upon the connexion between Buddhist temples and Druidical remains, the conviction will make itself felt in the drawing. In matters of such delicate rendering as Egyptian hieroglyphics, Sinaitic carvings, Cuneiform inscriptions, the question whether this or that mark upon the weather-worn stone shall be recorded as the remains of a line or a dot, or shall be overlooked as a defect produced by age, will be decided, in the work even of the most conscientious draughtsmen, by the interpretation which he places upon the symbols he is recording. Such inaccuracy in the observer generates a corresponding inaccuracy in the student who generalizes from his observations. The student knows how the observations are taken, and justly looks upon them as all more or less arbitrary and conjectural; he is ready enough, therefore, whenever he is hopelessly at a loss, to evade the difficulty by audacious emendation. After all, the error may have been only the copyist's doing, and the true original may be in favour of his view. The pictures of the sun are subject to no such damaging suspicions. The scholar studying in the British Museum may have before him in a photograph the hieroglyphics from Carnac, or the inscriptions from Persepolis, or the outlines of a Buddhist temple in Ceylon, not as they may appear after they have been filtered through the brains of an imaginative artist and his engraver, but as they actually are, traced by the hand of the same unerring natural law as would have painted them on his own retina had he been there.

### Reproduction of Historical Documents.

There is one other application of photography to the purposes of science which is impeded by no difficulties of this kind, and the neglect of which, therefore, is capable of no similar defence. Students in all these branches of learning which depend upon manuscript records—the philologist, the historian, and, above all, the theologian—have reason to complain that it has not been more largely employed to secure from the risks of time the stores from whence they draw their knowledge. It is notorious that, for the scholar's purposes, a printed book is no substitute for the MSS. on which it is nominally founded. Very few editions even profess to reproduce with rigid accuracy any particular MS. The editor uses his judgment in making this or that departure from the ordinary text, and in recording it if he does so. And even where an exact copy is professedly given, it is subject to all the ordinary fallibility of human work. Each new collator who consults an ancient MS. finds a fresh harvest of corrections to be applied to his predecessor's labours. And, beyond this, there is much in every MS., in its arrangement and in the character in which it is written, which no printed book can, without enormous cost, bring fully before the scholar's eye. The MSS., therefore, from which our knowledge of ancient literature is drawn are still an inestimable possession, in spite of all the printed editions that have been drawn from them. It is a possession, it is needless to say, resting upon the frailest tenure, which war, or revolution, or accidental fire, or careless exposure to damp may at any time terminate. It is strange that, when science offers a guarantee against such accidents, the learned bodies or the governments of Europe have in so few cases made any effort to secure it. Both Sir Henry James and Mr. Osborne, of Melbourne, have shown that by the bichromate process any document can be unerringly and cheaply reproduced upon zinc or stone; and, so reproduced, any number of absolute facsimiles might easily be printed off. Or, to make the security of accuracy more perfect, they might be printed direct from the negative by the carbon process. Such a multiplication would have the double advantage, that it would place copies, indisputably accurate, of all important MSS. in every great European library, and it would make any risk that the originals might run, in this troublous age of the world, a matter of secondary account.

### Photographing Engineer's Drawings.

By means of a photographic process, copies of drawings can be made rapidly and cheaply of the same size as the originals. The original drawing is in no way injured by the process, and the copy is produced by simple superposition over the chemically prepared paper, and is a positive copy direct without the intervention of a negative.

### Photography in Natural Colours.

The *Cerneau*, a paper published in Port Louis, Mauritius, contains the following extraordinary announcement, according to *Galignani*:—"M. Chambay has succeeded in fixing the colours of the object. The picture is taken instantaneously, as in other kinds of photography. The modelling and relief are marvellous: the blood appears to circulate beneath the skin; the colour is fixed; and the portraits, which present a surprising resemblance, are equal to the finest pastels, miniature, or water-colour drawings. M. Chambay is about to remove to Paris."

### Power of the Magnesium Light.

A singular circumstance was communicated to the French Photographic Society at its last sitting, by M. Placet. The magnesium light is so powerful, that when placed at a short distance from the object-glass, it will melt its surface. An object-glass spoilt in this way was produced by him at that sitting. Photographers had better take the hint, and not bring the light too near the apparatus.

## Statistical Information.

### The Cotton Supply Restored.

In the circular issued to the cotton dealers of England by Messrs. Neil Brothers is this paragraph:—

Cotton trade writers generally still industriously keep up the notion that the course of prices of this staple depends upon American politics and the state of the money market, studiously ignoring the fact demonstrated by the figures given below that, owing to the increased supplies from all quarters on the one hand, and the permanent decline of demand from economizing of material and substitution of other fibers for clothing on the other hand, our supplies of cotton, independently of America, are now in excess of the requirements.

They also give the following table:—

Supplies of cotton to the United Kingdom from other countries than the United States, but including latterly small receipts of American cotton from Matamoras and through the blockade:—

| | Bales. |
|---|---|
| 1858 | 577,000 |
| 1859 | 744,000 |
| 1860 | 784,000 |
| 1861 | 1,194,000 |
| 1862 | 1,445,000 |
| 1863 | 1,932,000 |
| 1864 | 2,600,000 |
| 1865 (estimated) | 3,500,000 |

*Stocks of Cotton Dec. 2.*

| | 1863 Bales. | 1864 Bales. |
|---|---|---|
| At Liverpool | 249,509 | 383,800 |
| At London | 43,500 | 117,700 |
| At Havre | 26,200 | 61,800 |
| Total | 319,200 | 563,300 |
| | | 319,200 |
| Increase of stock in 12 months | | 244,100 |

### The English Post Office.

The Postmaster-General's report for 1863 shows that the correspondence of the kingdom has risen from about 70,000,000 of letters in 1839 (the last year preceding the introduction of penny postage) to upwards of 640,000,000 of letters in 1863. The tables show that the increase in the number of receptacles for letters throughout the kingdom has increased at the rate of 52 per cent., whilst the inhabited houses throughout the kingdom have increased at the rate of only 8 per cent. The foreign and colonial letters coming into the United Kingdom for delivery are about one-fifth of the whole number of letters delivered, and the letters despatched to foreign countries and colonies are nearly equal in number to those which are received. The most remarkable increase is in the case of France. In 1854, before the reduction of postage thither, the correspondence amounted only to 3,000,000 letters; in 1857 it was 4,206,000; and in 1863 it had reached 6,373,000. It is believed that 15 per cent. of the total number of letters posted in London contain printed enclosures, mostly advertisements.

### Coral Fisheries of Italy.

According to a report to the Italian Government the coral fisheries, which are a great resource for the poorer classes, employ 460 boats, manned by about 4,000 men. The fishing implements, pay of the men, board of the crew, etc., absorb annually about 6,000,000 francs, distributed among more than 6000 persons of different professions. About 160 tuns of coral are annually introduced into the kingdom of Italy. The articles made of it and exported are to the value of from 12,000,000 to 16,000,000 francs yearly, principally sent to Asia, the interior of Africa and America.

### South Australia.

The population of South Australia is now 140,416. It possesses 50,008 horses, 226,166 horned cattle, and 3,891,642 sheep. It produced last year 4,691,918 bushels of wheat, and 606,565 gallons of wine. Its exports amounted to £2,738,226, and its imports to £2,062,448. The revenue of the colony is expected to realize this year £672,000.

# Miscellaneous.

### Pneumatic Dispatch and Telegraphy.

Recently a pneumatic dispatch apparatus was tried in Manchester in connection with telegraphy. Owing to the increase of their business in Manchester, the Electric and International Telegraph Company has lately taken extensive premises in York street, and opened a central station there. In order to facilitate the rapid dispatch of messages from the branch offices at Ducie Buildings (Royal Exchange) and No. 1 Mosley street, it has been deemed advisable to connect these offices with the central station by means of the pneumatic system, the same as is adopted by the company in London and Liverpool. Between the branch offices above mentioned and the central station leaden pipes with an inside diameter of 1½ inches have been laid down under the streets. The leaden pipes are made perfectly air tight, and are inclosed in 2-inch iron pipes to protect them from being damaged. At the central station there is fixed in the basement a small high-pressure beam engine, and connected with it a double-action air pump, 17 inches in diameter and 15 inch stroke. The pump is continually at work exhausting the air from a cylinder 8 feet long and 4 feet in diameter, which is styled the vacuum cylinder. The pipes which pass under the streets from the branch offices are terminated in the instrument room on the top floor of the building, and the pipes from the vacuum cylinder are also carried to the same place, and they can be put in connection by simply opening a valve. The carriers which travel through the pipes are made of gutta percha covered with felt. They are about five inches long and of a diameter nearly equal to that of the pipe. They are hollow inside for the purpose of containing the messages. Electric bells are employed to give the necessary signals for the working of the pipes.—When the officials at the Ducie Buildings office wish to send a "carrier" they place one in the mouth of the pipe and signal the central station by ringing its bell. The clerk in attendance at the latter place by moving a small lever, puts the pipe in communication with the vacuum cylinder. The air in the pipe then rushes into the vacuum cylinder, and the "carrier," having the ordinary atmospheric pressure behind it, is propelled through at a speed of from 35 to 40 miles an hour. On the arrival of the "carrier" at the central station it strikes against a spring buffer, which, by a simple self-acting contrivance, cuts off the communication between the pipe and vacuum cylinder, and the carrier falls from the valve on to a counter prepared to receive it. To send a "carrier" from the Mosley-street office the action is precisely the same. By using a second chamber, and compressing air into it, a force is obtained for blowing the "carriers" from the central station to the branch offices, so that the pipes can be made available for carrying in both directions. The branch office in Mosley street is about 320 yards from the central office, and the distance of the Ducie Buildings from the branch office is 510 yards. The time occupied by a "carrier" in traversing the shorter distance is 22 seconds.—*Engineer.*

### Grease for Leather.

In smearing leather with oil we aim not only at making the leather pliant, but also at making it water-proof. Train-oil is often used for this purpose, but no fat gives more imperfect results; for no liquid fat is suited to render leather permanently water-groof, train-oil possesses this characteristic, that after a while it dries up, and then the leather becomes brittle. Hog's lard is admirably adapted to secure both objects, pliability and impermeability to water, It renders the leather perfectly pliant, and no water can penetrate it. It is especially suitable for greasing boots and shoes; but in the summer season an eighth part of tallow should be melted with it. It should be laid on when in a melted condition; but no warmer than one's finger dipped in the mass can bear. When it is first applied to a boot or shoe, the leather should be previously soaked in water, that it may swell up, so that the pores can open well and thoroughly absorb the lard. The liquid lard should be smeared over the article to be water-proofed at least three or four times, and the sole leather oftener still. Afterward the lard remaining visible on the outside should be wiped off with a rag. By this means you may have a water-proof boot or shoe, without the annoyance caused by most stuffs of penetrating the leather and greasing the stockings. An occasional coating of hog's lard is to be recommended for patent-leather boots or shoes, as it prevents the leather from cracking, and if it be not rubbed in too strongly the leather will shine just as well after the application.—*Shoe and Leather Reporter.*

### A Scottish Opinion of American Ingenuity.

No people are so full of ingenious little expedients for saving labor and material as are the Americans. The force of circumstances has made the Yankee a master in the art of extemporizing little "dodges" in mechanism. Self-help is the great lesson a man receives when he sets foot in a new country, and it is in the invention of helps in metal and wood—helps which need no wages, and which never strike, or tire, or grow sick, that the New Englander excels. There is nothing out of a pantomime more ludicrously clever than some of the inventions which have of late years been introduced into this country from the West. The process of making common pails by machinery is so rapid as to baffle the eye, and so comically instantaneous that the stranger who witnesses it for the first time laughs over it as a most excellent joke. There is a "whiz" of revolving wheels, a sputter of light shavings, a procession of little staves chasing one another in the air, then another whiz of the collected staves, and the bucket is hooped and made. Scarcely less amusing is the little mechanical device for paring apples by machinery. The machine is the veriest toy—simple and cheap—but it brings off the rind with an almost magical delicacy, and while it pares the fruit with an accuracy which seems to bespeak a special sense of touch, it slices the apple and takes out the core at the same time. Success in such small matters has made the American bold, and has trained him into habits of innovation. So far from dreading novelty, he likes novelty for its own sake, and to secure it he often reverses our way of doing things. In his steamboats he builds up the cabins tier over tier upon deck instead of below, and he suffers the engine to work high in air above the many stories of cabins. When he wants to put another story to a great building he adds the new floor at bottom instead of at the top, and be it a bank, hotel, or huge store, he is ready at your command either to lift the entire block or to slide it on its travels to a more eligible location. In printing newspapers he builds his type upon cylinders instead of laying it upon the slow working table, and he makes the machine "pick up" and "take off" its own printed copies with a regularity and a neatness which no number of trained hands can equal. His gunboats are floating martello-towers that can fire fore and aft as readily as from the side. His river steamers are amphibious, and may go anywhere where it is a little damp. He is partial to machinery because it does not grumble, is not impudent, is not extortionate; and hence it comes that his crops are gathered with patent reapers, his linen is washed with wooden hands, his cows are milked by the patent cow-milker, his potatoes as well as his apples are pared by one of the queerest little kitchen-maids, who has no "followers" and who wastes none of the fruit; and even his chairs, his tables, and his cabinet-work in general come from manufactories large as our cotton-mills, where they are turned out in parts by swift-moving machinery. —*Dundee Advertiser.*

### Acorn Coffee.

"Opening an old book the other day, I found a receipt for making 'acorn coffee;' so I gathered some acorns and had them prepared, and I must say that it was the best imitation of coffee I ever drank. In fact as palatable as 'prime old Java.' As there is a large crop of acorns this year, the following receipe for making the coffee may interest some of our readers. Take off the hull and dry the kernel; roast and pulverize it; when making a decoction, use as much as you would if you were measuring the genuine 'Mocha' from Arabia."—*Exchange.*

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The best way of raising money is by the lever of industry. The griping miser raises his by screw-power.

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The natural productiveness of one land tends to alleviate the wants of another less highly favored, thereby establishing a system of exchange and communication known to us in this busy world by the short but comprehensive word, *commerce.*

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There is no more beautiful object than a soap bubble. No flower or precious stone excels it in symmetry. None equals it in color.