CANADIAN MECHANICS MAGAZINE AND PATENT OFFICE RECORD

Vol. 6. MARCH, 1878. No. 3.

MORE TECHNICAL EDUCATION REQUIRED IN OUR PUBLIC SCHOOLS.

(*Continued from our last.*)

WHEN, in our leading number of last month, we spoke of reform required in our public schools, for the better education of mechanics, let it not be supposed that by providing them with the means of obtaining knowledge, they would all acquire skill and taste, or that many of them would become great inventors in mechanics, discoverers in science, or great designers in the arts. It is only men gifted with genius that rise to great eminence, and these men train themselves to intense study and application after the usual term of a school education has been completed. Although he who strives for great things will, in the long run, usually obtain more than he who is less ambitious, still the ambition of the working mechanic, unless gifted with talent of a high order, should have a more modest aim, and his education be such as to be of the most service to him in his trade; and, then, should he feel inclined to exercise his powers and enlarge the boundaries of practical mechanics, or of science and art applied to industry, he will be competent to do so.

One of the main objects of a technical education is, that it is sure to bring about satisfactory industrial results; the workman becomes more intelligent, and, should he have genius, will not waste his time or money on mere speculative theories, but make economical applications of whatever has been invented, discovered or designed. To this end there is special need that the eye be trained to quick and accurate perception, the hand to quick and accurate execution, and the taste to discriminate between what is good and what is bad. The mere teaching of workmen to read, write and cipher, has no direct bearing on the work of their hands. But let the whole people be educated in the elements of industrial science and art, and what will be the result? The result will be that we create a popular appreciation of whatever is excellent in workmanship, beautiful in design, and health promoting. When these feelings are created in the mind, the inventor has a greater incentive to set his wits to work for improvements. There is a greater appreciation of the laws of health, of good drainage and pure air, and, also, of a general appreciation of the artistic and beautiful in manufactures. Without such education the designer exercises his æsthetic power in vain, and workmen of good natural ability are deprived of the most effective means for improving their condition.

No matter in whatever light we look at the question, we must come to the conclusion that if the Dominio of Canada is to become rich and powerful, and not behindhand with other countries, her people must be educated in the elements of industrial science, and it is only by so doing that labor of every kind can secure its full reward; only by this that manufactures and commerce can attain their highest prosperity. But to secure these results, it is necessary that the curriculum for technical education in all our public schools should be the same, and that the books fixed upon by a committee of scientific men shall be in the simplest form, stripped of all ambiguous language and lengthy complicated description. It has been too much the custom in our public schools of late to change the books in use—often to the detriment of the scholars—and which is frequently done at the mere whim of the teacher. The number of unnecessary books that have to be bought by parents for their children, out of which they often learn only a few lessons, is a heavy tax upon parents, and is the actual cause of many children being taken from school before they are sufficiently educated.

We have said enough, however, to convince thoughtful people that an educational revolution is justified by the radical changes in the conditions of life that have so rapidly taken place of late years, and to show that the system of our primary school education needs readjusting and brought into harmony with those popular needs of the age that can be met only by instruction in physical science and industrial art. Every artisan must be taught to put more skill and taste into all the products of his hand, and have a better appreciation of physical science and its practical application.

As it is evident that industrial art must form one of the essential features of a new system of education, the prime element of that system naturally becomes that of

INDUSTRIAL DRAWING,

which is the most essential single element required in all industrial pursuits. Neither architecture, sculpture nor painting can get on without drawing; drawing not only expedites construction in all cases, but oftentimes construction is absolutely impossible without it. In order to obtain the greatest expedition and economy there must not only be professional draughtsmen to make original drawings, but workmen must know at least enough of the principles on which drawings are made, to be able to work from them understandingly and without constant supervision. As a result of the value of the art to many, we give the following extract from a work on drawing adopted by the Board of Education in England:

"In almost all trades, decorative art in some way makes its presence felt; but in some, as we are all aware, it is present in a marked degree. In these branches of business, more especially, the power of drawing is of great value. Many persons are not aware at what disadvantage we are placed, nationally, by this past neglect of the art-power, which it is not unreasonable to suppose is latent amongst us. The following quotations from a Blue Book, compiled on the Government inquiry, in 1864, into the working of the Schools of Art throughout the country, may not be without interest. One of the leading Manchester calico manufacturers, during the course of his examination, says: 'I have made a calculation, which I believe to be within the mark. I believe the amount paid by calico printers alone, at this very time, is enormous. I may state at once that I know twelve houses that pay from £25,000 to £30,000 a year for designs. I believe the entire payment now in the trade, in French designs alone, is upwards of £50,000 a-year. We get much better designs in Paris: unless it were so, we should not go there, of course.' One of the chief manufacturers in the Staffordshire china trade, in answer to the question—'Are your best designers now foreign or English?' replies—'Our best painters, with the exception of one, are foreigners; and I may state, also, that our best modeller is a foreigner.' In France and Germany, technical art training has been in full practice for a great many years, with what valuable results the foregoing extract will show."

It is therefore clear that, in elevating the tastes of the people, you inevitably elevate the manufactures, increase their value to the country, and give full employment to the people.

To the Editor of the CANADIAN MECHANICS' MAGAZINE.

HAMILTON, February, 1878.

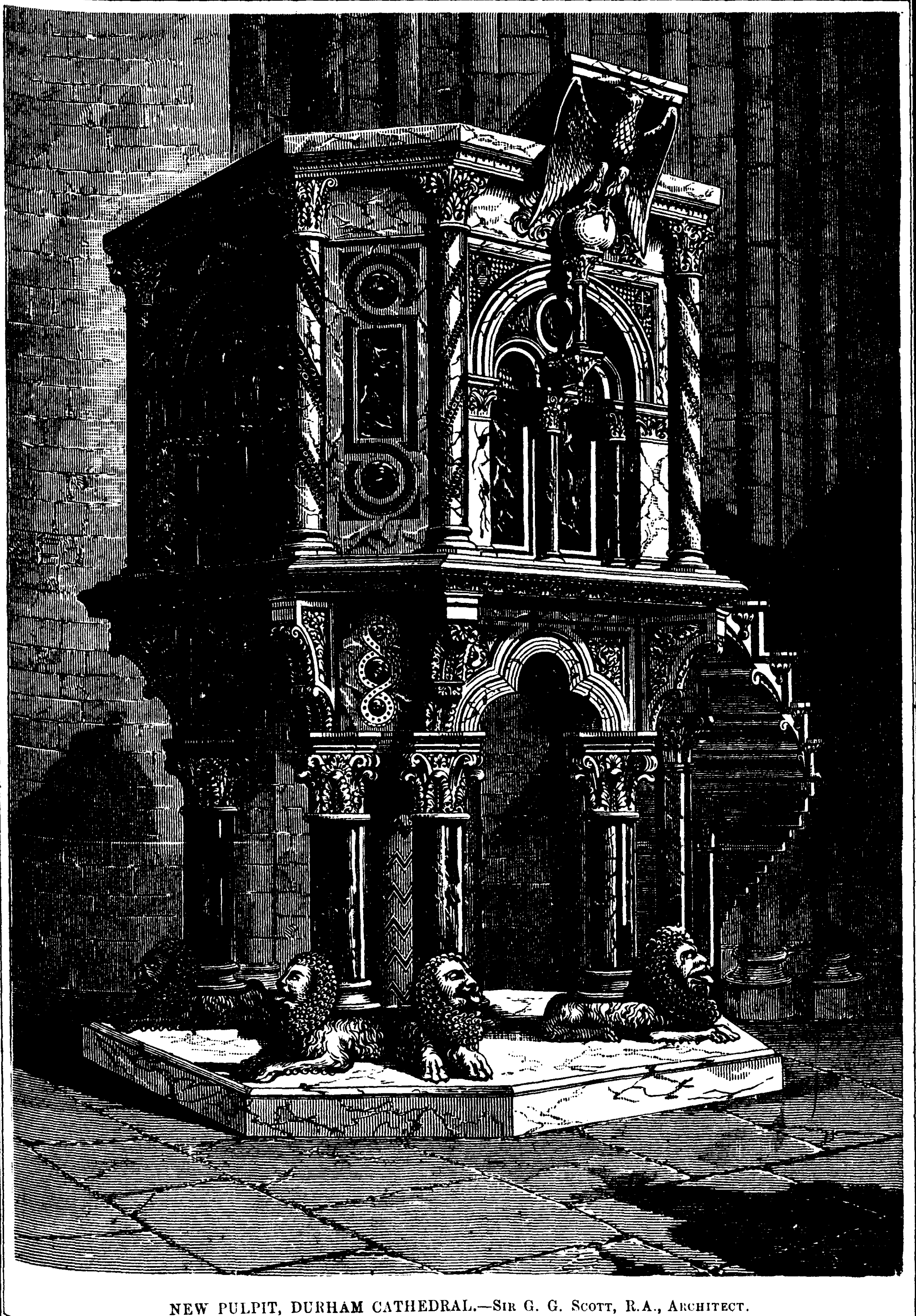
SIR,—

An invention of a novel and ingenious kind has just been put into use in this city by Mr. J. H. Kelly, of the Mona Iron Works here, for the purpose of utilizing waste coal or screenings of every description without the use of a fan or blower. The invention consists of an apparatus constructed like the petticoat or blow pipe arrangement used in a locomotive smoke box and under the smoke pipe or funnel, but inverted. This apparatus is supplied with steam from the boiler through a small pipe in first cone or petticoat, not more than 1-16th diameter; after these there are a succession of cones, five in number, of continual increasing diameter through which the combined current of air-steam passes, forming a powerful blast which can be changed by more or less steam if desired. This blast is conveyed under the grates which are placed over an air-tight ash pot and forced through the fire, which, in this case, was composed of hard coal screenings, previously lighted by a wood fire. The screenings which are sold here, in the yard, at 50 cents per ton—by aid of the apparatus give off a large amount of heat and blaze up with powerful blue flame, the intensity of which is regulated by the amount of steam introduced with air. The boiler to which it is applied is about 20 horse-power, and runs a fifteen horse-power engine driving the numerous tools in the machine shop of the Mona Iron Works, also heating the various work-shops by ranges of steam pipes, and working a powerful steam hammer in the forging shop. All this work is done for the whole day of 10 hours with under 600lbs. of this waste material, the steam being steadier and in greater quantity than it ever was previously with the best steam coal. An experiment was tried this afternoon in the presence of a number of gentlemen showing the value of this invention. At 15 minutes to 4 o'clock three small shovelfuls of hard coal screenings was put into the furnace, the steam being at 50lbs. above the atmosphere. The whole of the machinery was kept in motion and run until 5.15, or for one and a half hours, the steam at the time of stopping being 82lbs. above the atmosphere. The cost of the screenings in one day of 10 hours being under 20 cents, which has been pronounced as the cheapest steam power known. This apparatus utilizes millions of tons of refuse which are heaped in immense mountains around all the anthracite coal districts. Immediately on its being known in this city that the success of this device being assured, the whole of the screenings here was bought. It has now doubled in value, being worth one dollar a ton; at this price, with this apparatus, it is less than 1-5th of the cost of steam coal. One curious feature of the matter is that a very much less weight of screenings answers the purpose than is required of the best steam coal. This is explained by Mr. Kelly as being due to the decomposition of steam. Mr. Kelly is manager of the Mona Iron Works here, and is a man of marked ability, having originated many valuable inventions—his automatic condensing engines, without an air pump, being known far and wide.

AN ENGINEER.

Dried Eggs.—A large establishment has been opened in St. Louis for drying eggs. It is in full operation, and hundreds of thousands of dozens are going into its insatiable maw. The eggs are carefully "candled" by hand—that is, examined by light to ascertain whether good or not—and are then thrown into an immense receptacle, where they are broken, and by a centrifugal operation the white and yolk are separated from the shell very much as liquid honey is separated from the comb. The liquid is then dried by heat, by patent process, and the dried article is left, resembling sugar; and it is put in barrels and is ready for transportation anywhere. This dried article has been taken twice across the equator in ships, and then made into omelet, and compared with omelet made from fresh eggs in the same manner, and the best judges could not detect the difference between the two. Is this not an age of wonders? Milk made solid, cider made solid, apple butter made into bricks! What next?—*The Age of Steel*, ii, 16.

Wonderfully Rich Gold Mine in New Zealand.—The mail delivered during the week brings intelligence of one of the greatest discoveries yet made in the province. The discovery is at the Moanatairi Mine, in the Thames gold field, not a great distance from the celebrated "Caledonia" Mine, which in two years returned half a million sterling from a depth of 50 fms. The Moanatairi Mine was productive to a depth of about 200 feet, when the lode became very poor. The company, nevertheless, decided to carry on operations, although at a great loss; and, after working for over two years, struck the lode again nearly 100 feet deeper, when it was found to be from 8 feet to 10 feet wide, and almost solid gold. The returns since have been enormous—for the fortnight ending March 3,709 ozs.; March 17, 4,913 ozs.; March 31, 16,662 ozs. Making a total of 22,284 ozs., of the value of 70,000*l*. The yield for the last week of the above return was 10,298 ozs., and the profit for the fortnight reached the amazing sum of 83,000*l*.



NEW PULPIT, DURHAM CATHEDRAL.—Sir G. G. Scott, R.A., Architect.

TALKS WITH APPRENTICES.

Apprenticeship, twenty-five or thirty years ago, was something very different from what it is now. The lad who desired to learn a trade found little difficulty in obtaining a situation, and generally he was provided with an agreeable home in the family of his employer. It is not the custom now-a-days to take the boy into the family, for, in truth, the family too frequently does not care to recognize the shop. Between it and the bench and lathe, and forge, there is an impassable gulf.

An honest, industrious, and well-disposed boy, who goes out from his quiet home to cast his lot among strangers, in order that he may learn to become a skilled workman in some branch of useful industry, has rather a hard time of it. First, he is lonely—inexpressibly so; and to make his case worse, he is considered the lawful prey of every older boy, and the jesting-stock of thoughtless workmen. Accustomed to kind treatment, and to more or less of the refinements of a home, he is now compelled to submit to rough usage, and sometimes to treatment that is absolutely brutal. If he is quiet and good-natured, or if he has sufficient well-disciplined muscle to compel the older boys to respect him, he will make his way in the shop. But what is he to do with himself nights and Sundays?

We write these lines in the hope of being able to give some acceptable advice to the boys regarding this very question; advice which, if they will heed and follow, may prove in the end a mine of wealth to them. Not that it will make them rich in money; but, rather, in things that money cannot buy.

Nights and Sundays! Well, indeed, who would suppose it possible for a boy to find it difficult to dispose of his leisure hours? But we speak of the boy fresh from home, and commencing life among strangers. A little later on, after he has made acquaintances, and his notions as to what a boy ought to be in character and life have undergone somewhat of a change, we fancy he will not be lonely. The chances are that he will then do just as the majority of other boys—spend his time without profit to himself, and in a way that works him permanent harm. And we may as well say right here, that if the boy who reads these lines has got into the habit of roaming about the town nights and Sundays, and is unhappy without his pipe and beer; if he goes to every place of amusement his purse will allow, and sets great store on a round at whist or euchre, and other games; in short, if he has learned how to idle away his priceless hours of leisure, then what we say will scarcely be of benefit to him. But let us get back to our boy fresh from home.

About the first task set before him after securing a situation will be the selection of a place to board. He will be directed to a boarding-house, and, very likely, requested to occupy a room in company with others. Here he must make his first fight. His whole future depends on his stubborn resistance to any such arrangement. What he wants is a room entirely to himself, and this he must make every possible effort to secure, even though he be compelled to select an unfurnished garret in a rickety old house. And he must find a room with a chimney in it—if there is a fireplace, so much the better, for our boy will require fire.

Here let him pitch his tent, and make up his mind to call this dreary place home; for dreary enough it will be for some time to come. But there will be a certain sort of independence about this arrangement, and it admits of a start being made towards perfect freedom from any dependence for rest and pleasure on one's outside surroundings. Let him bear in mind, too, the importance of a fire, for it will alwaye give him a welcome in the long winter evenings; and coming in late, he will often be able to spend a pleasant hour, book in hand, that otherwise would be lost in sleep.

Domiciled in this little room, though poor in purse, he will begin to set about furnishing it. At first a rough table, a chair for himself, and one for a chance guest will be all that he requires. He will get out his little store of books and writing materials, and photographs of the dear ones at home, with what few keepsakes he may have; arranging these on his table, he begins life. If he works in wood, it will not be a long time before he will be able to add a few articles of furniture that will be useful as well as ornamental. Whatever he can get the time to manufacture he will have a place for, and he will know how to appreciate its value. As the days go by he will continue to add to his possessions. He will pick up now and then a choice engraving, or a pair of vases, and get a carpet on his floor. There will be growing plants in his window, and a canary to sing him welcome when he comes in after his day's work is done. We draw this picture in order to show that there is no absolute necessity for him to room with a lot of rough fellows unless he chooses to do so. If he can find a pleasant room, furnished, where he can have a fire and be by himself, so much the better; if not, let him hunt for an attic, nor rest until he find it.

Now, having seen our young friend settled, and ready to begin the years of his apprenticeship, the subject grows upon us; and we feel inclined to not be content with telling him what to do during his hours of leisure, but to talk with him on a variety of subjects; so it seems to be necessary that this article should prove the first of a series. In our next we will endeavour to tell him something about what proportion of his leisure hours should be spent in his room, and how to pass them with profit and real pleasure. And he must not get the idea into his head that we desire to make of him an anchorite, for nothing is further from our thought. We will talk to him of companionships and amusements, for we believe a good deal in the latter—"all work and no play makes jack a dull boy,"—and of many other things that we think will profit and please him.

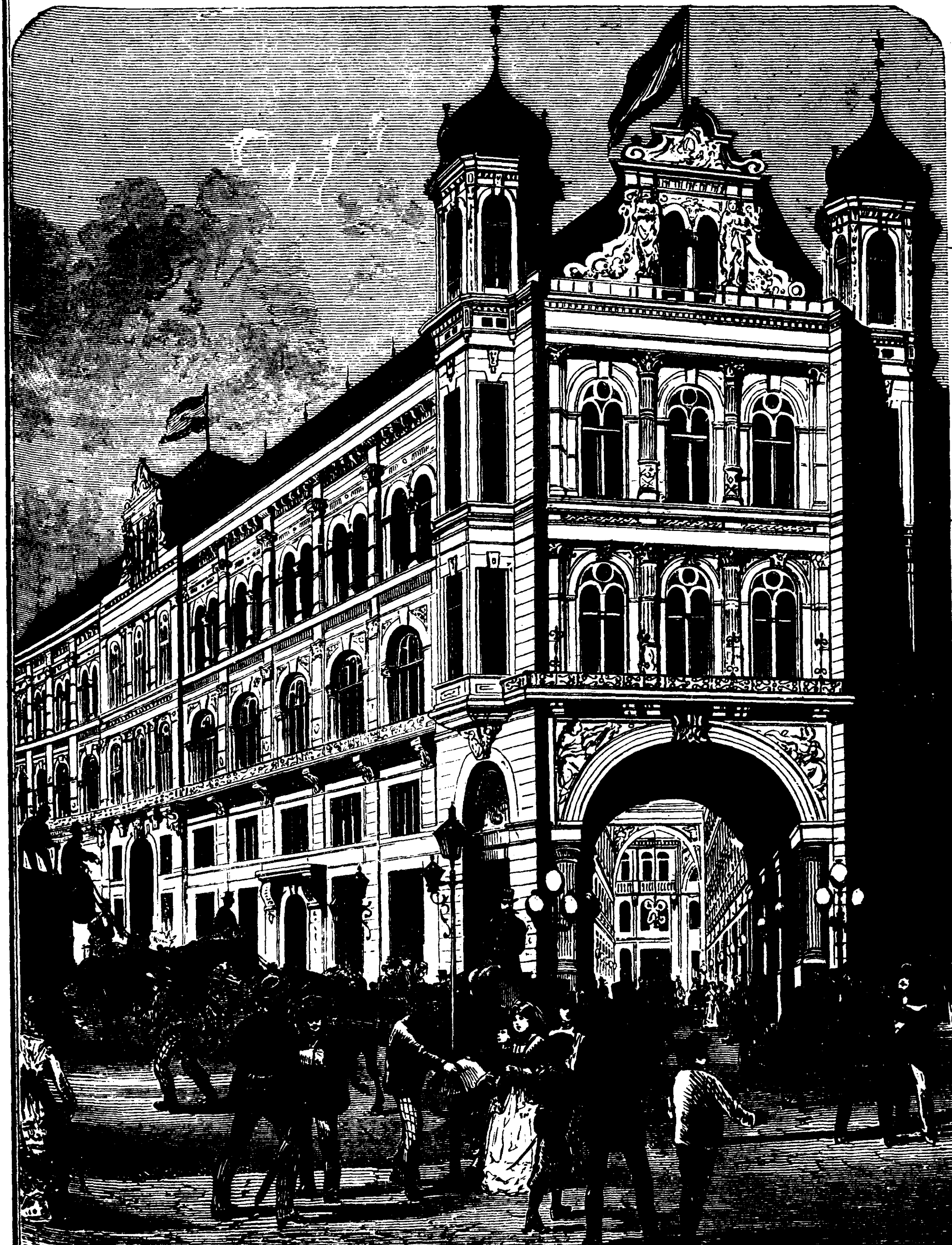
American Builder.

The Process of Cremation suggests a means to solve the serious question, what shall be done with the street refuse and garbage. An analysis of collections from 13 representative districts give the following average results:

Water,	3.032	per cent.
Nitrogen	0.369	"
Combustible material	28.454	"
Incombustible material	68.514	"

Prof. Chandler, President of the Board of Health, suggests that a system of garbage cremation in furnaces similar to those in the manufacture of shell-lime. It is said that 200 tons of refuse and garbage can be cremated and rendered innocuous in 24 hours. Such a system would involve less cost than conveying it to deep-water, and be far more consistent with the demands of civilization and public safety.—*Am. Architect.*

An Improved Foot-Bellows are proposed take the place of the old fashioned hand-bellows. They are set end to end on a platform and connected with a strap, so that when one is in a state of collapse the other is full, thus keeping up a continuous current at all times.



THE IMPERIAL GALLERY, BERLIN.

KITCHEN MANAGEMENT IN FRANCE.

(From the *Boston Journal of Chemistry.*)

No more interesting or profitable investigations have we ever made among any people, than those which relate to kitchen management in France. The tourist has no difficulty in gaining access to the homes of the most lowly, and everything is open to inspection. It used to be the custom in that country, when the traveller alighted at any little wayside inn, to show him the kitchen and larder before opening the bed-chambers for inspection. In 1855-56, a period when there were fewer railroads than now, we journeyed leisurely through France, and obtained views of interior life which are not easily forgotten. From these observations we unhesitatingly declare that the eating in middle-class French houses, inexpensive as it is, is certainly far superior to that of the majority of the richer classes in this country. It consists of few dishes, of smaller quantities; it is composed of low-priced articles, and reference is had to the amount of nutriment secured. The French are too poor and too wise to waste money in the purchase of fish, flesh, or fowl, when these cost more than their nutrient or current values. They study the markets, and select such foods as are sold at reasonable rates and furnish muscular and nerve strength. And then, there are none so poor or saving as not to require that each dish shall be itself, with its full aroma, its full essence,—every particle of nutriment made available. Poverty in that remarkable country does not prevent the exercise of culinary skill; it sets the latter off against the former, it replaces money by intelligence. Every housewife spends the money allotted to the purchase of foods in a way to produce its utmost value, not only in quantity and quality, but, what is even more important, in suitability. The provisions are bought with reference to the use which is to be made of them, and no more than is needed in twenty-four hours is purchased at one time. A French woman knows that a cheap chicken will serve for boiling, and the water is invariably made into a nice soup with vegetables. A better fowl would be selected for roasting, especially if guests are expected. Cabbage, asparagus, and artichokes are more nutritious than potatoes, and therefore they are oftener seen upon the tables of the French peasantry. Dark bread, made from whole wheat and barley, is the only kind used, and eggs, which are usually cheap, are largely consumed. Scarcely any butter or cheese find their way to the tables of the poorer classes; they are too costly.

Everything is eaten up clean, and each morsel of nutriment is extracted. The bones of animals and fowls are broken, and the marrow forms the basis of the excellent soups, so common everywhere. Upon the table there is usually just enough for the family; so no one has a chance of leaving hardly a crumb. Waste is suppressed, because it cannot exist without a surplus, because its very possibility depends on an excess of supply over consumption. From experience and observation the French house-wife knows how much weight of food she requires at each meal, and she provides that and no more. If at dinner there is more provided than is absolutely needed, it is known that the evening meal will be lessened in consequence. The peculiar economy of the French is manifested in the purchase of the cheaper articles of food. In the cities the cheaper portions of the meat of animals find a readier market than the dearer, and it often happens that the best or choicest cuts remain upon the market-men's hands until a late hour in the day, and are then sold at reduced prices. A large piece of meat is rarely seen upon the tables of even the richer classes in France ; the portion is usually small, and the meal is supplemented with a fair allowance of soup, bread, and vegetables. This management does not lessen the attractiveness of meals, or indicate unpleasant parsimony. Small dishes of each sort of food, cooked in savory and palatable form, enable French housekeepers to economize on the dearer articles, and herein we should learn from them an important lesson.

Another matter connected with French kitchen management claims attention, the great economy of fuel. It is a prominent maxim that a small dish requires but a small amount of fuel to cook it, and a pint or a quart of charcoal will do more work in a French kitchen, than ten pounds of anthracite will in ours. Cookery is carried on almost exclusively with wood or charcoal fires, kept down to a low smoulder when not needed for the moment, and roused up to activity in five minutes when the time comes to use them. The same exact adaptation of means to ends is discovered here as in all other details of the subject: a fire to roast a chicken is made just big enough to serve the purpose; the combustion of a cent's worth of charcoal boils or stews the contents of two saucepans at the same time ; as soon as the operation is complete, the fire is covered up with ashes, or put out. Small quantities do not take so long to cook as large ones, so they need heat for a shorter period ; and even in the case of soups which require hours of gentle simmering to bring them to the point, the very nature of the process prohibits strong flame and its accompanying loss of fuel. In cities, Paris particularly, families have their cooking done at cook-shops, of which there are many in almost every street. A housekeeper goes to market in the morning and purchases a joint of beef, or a fowl. It will cost perhaps four centimes to cook this at home; at the cook-shop it can be roasted for half that sum, so it goes to the shop, and at the hour specified it is returned in fine condition. One of the sights of Paris to a stranger is these cook-shops at about the hour of twelve, when the whole establishment is aglow with flame and permeated with the odors of cooking flesh. They are usually open to the street, and one can look in and see the work done in all its details.

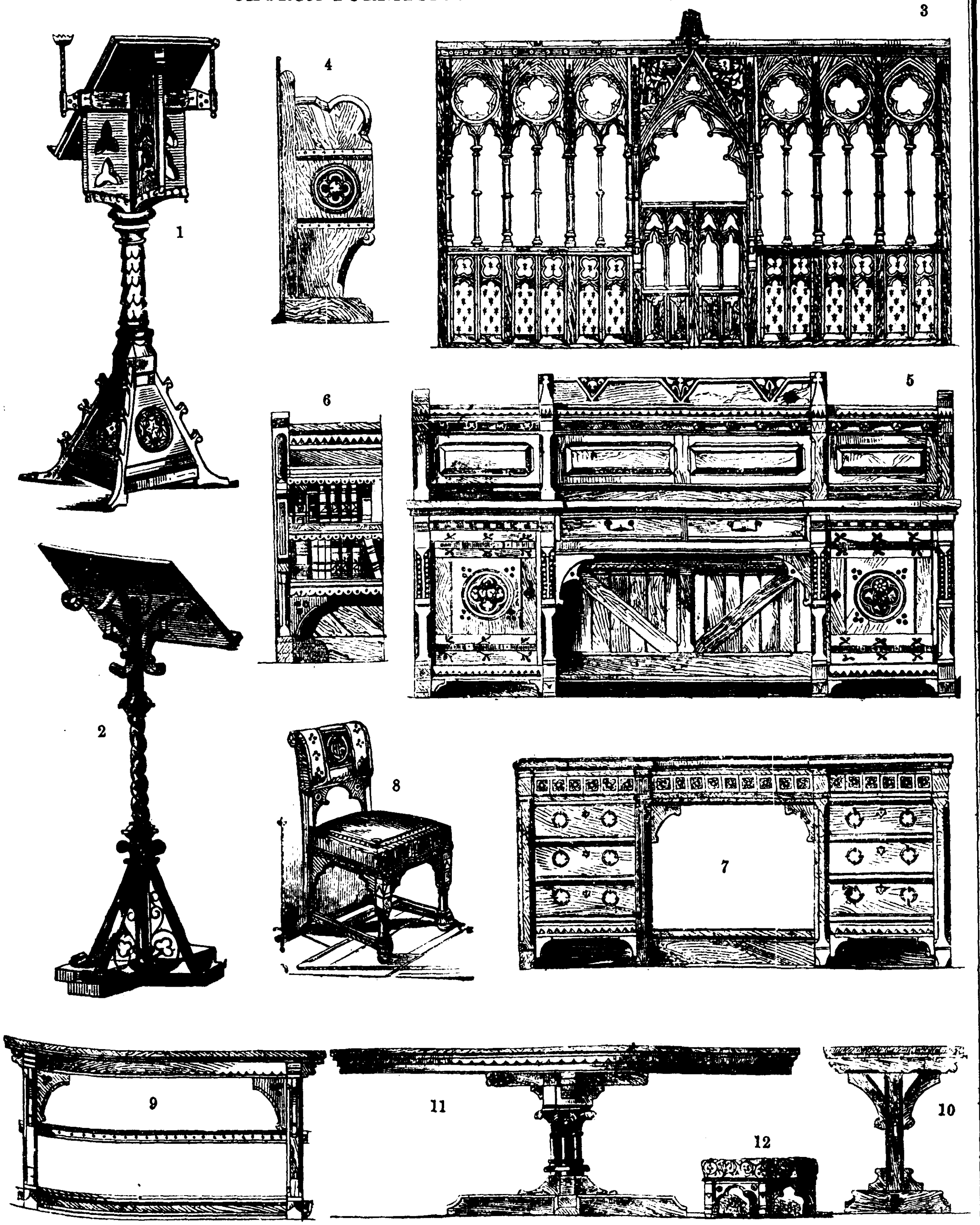
It does not cost a poor man, in France, one-half as much to cook a meal as it does in this country, and fuel of every kind is much dearer. Our big stoves and cooking ranges are in constant blast summer and winter, and there is a prodigious waste of fuel. The same amount of coal is consumed to boil a tea-kettle as is used to roast a sheep. We have not yet learned the first principle of economy as regards either the purchase and use of foods or the consumption of fuel. We are the most wasteful people that now exist, or perhaps have ever existed, and the waste in the poorer class of families is sufficient to sustain in perfect health an equal number of families of the same class in France.

The "waste-buckets" belonging to French families present a very different appearance from those found at the kitchen doors in this country. A French gentleman once observed to the writer that the Americans were a wicked people, as shown by their speculations, murders, drinking-habits, thefts, &c.; but in nothing was the wickedness more distinctly indicated than in the contents of the "waste-carts," as noticed in the streets of our cities. A people addicted to such wanton waste ought to suffer from protracted famine, or some calamity which would teach lessons of economy in the use of food materials.

We should learn from the French housekeepers and cooks several useful lessons. First, as regards the selection of articles of food by those of limited means, it may be said that good bread is indispensable in families, and to secure this, it is not necessary to purchase the whitest and highest-priced flour. The middle and poorer classes in France use but little white-flour; they have learned that the sweetest and most nutritious bread is made from wheat, barley and rye, ground finely but unbolted. Their bread is dark, but of excellent quality. Meats should be selected with a view to the methods of cooking to be adopted. The French never *boil* meats unless for the purpose of making soups. They regard boiled meats as comparatively worthless, and never serve them unless in some prepared form, to restore flavor and lost nutrient principles. We forget in this country that to *boil* food, be it meat or be it vegetables, is to extract from it, first, its volatile aroma, then its essences or juices, its nutritive power; and these go out in the hot water, which is stupidly thrown away. Boiling meat or vegetables in France is to make soup, and so saving are they, that even the water in which beans and cauliflowers have been boiled is always kept to serve as a basis for vegetable soup. Every liquid which has received the extracted flavor of a boiled substance is looked upon as precious, and is employed again in some form, so as not to waste the properties which it has acquired. The entire system of French cooking, both in form and practice, is to save the whole nutritive elements of every substance, to pass into the stomach, instead of allowing it to be poured down the sink-spout or sending it to the pigs. The lesson taught us in this regard should be heeded. Butchers' bones, and those of fowls, which here go to the waste-bucket or to the soap-boiler covered with fragments of meat and loaded internally with rich suet, are in France carefully sought for and employed in making soups. Nothing is wasted which can be used for human food ; soups are so common, it may be said the nation lives on them.

Employment of Dynamite in the Late Arctic Expedition.—The accounts of the English Arctic Expedition under Capt. Nare, show the application of many devices supplied by the advancement of science in overcoming the many obstacles presented by nature to guard the approach to the pole.

CHURCH FURNITURE. Designs by Cox & Sons, London.



Figs. 1 and 2. Lecterns. Fig. 3. Oak Screen, 12 feet high. Fig. 4. End of Choir Stall.

Fig. 5. Oak Sideboard, with inlays. Fig. 6. Book Case. Fig. 7. Carved Oak Library Table.

Fig. 8. Carved Oak Library Chair. Fig. 9. Communion Table. 10. End View of Table.

Fig. 11. Circular Library Table. Fig. 12. Foot Stool.

New Applications, Inventions and Industries Wanted.—One of the most important fields for present improvement, application and invention is in the greater production and utilization of the productions of the soil. Invention in rat-traps, nail machines, wire benders, screw cutters, and a hundred thousand ways of producing iron and metal appliances at a cost next to nothing are abundant; the country has gone crazy upon patents, but largely to no great service to anybody. What is now wanted is a little practical application to an increase in the farm products and their greater utilization.

The nation wants two blades of grass to grow where there is but one, two bushels where there is but one, two hogs, two cows and calves, two sheep and two hens, chickens and turkeys, and in many instances half a dozen of all of these where but one is now found. There needs be more and better butter and cheese, and a better care of it, more and better gardening and better care of fruits and produce when raised.

There wants preserving establishments, so that corn and tomatoes, and peas and pears and peaches need not be brought from Maine and California. Discoveries of processes of dessicating vegetables for foreign markets. Immense fortunes are now making in packing fruits at Eastern points; profit is making in St. Louis, in drying eggs and packing beef for other markets, and yet eggs are abundant at 7 and 8 cents a dozen and good profit in raising poultry. Beef, pork and veal and mutton are always in demand at a profit. America ships $20,000,000 of lard to France to be made into oil and shipped here again and to other points. Not half the milk is produced there is a market for. The rugged lands of the East produce milk and condense and can to a profit, so may the West.

Germany and France put up a vegetable, pea and meat soup material, giving a dinner for two cents. We want a dozen such industries. Dried and canned corn, dried and prepared squash, pearl barley, starch vermicelli and maccaroni, and many similar products.

Corn is now made into sugar with profit, but there should be a hundred such sugar establishments. Not half the attention is given to fall and winter vegetables that there is a demand for. Beets for sugar and for stock is an industry almost entirely neglected. Flax has no place at all in this country. If our inventive minds will give their attention to this branch of industrial development for a few years and demonstrate the practicability of a garden of Eden and a good living in every plat of 10 acres they will do the country a service.—*The Age of Steel*, ii. 8.

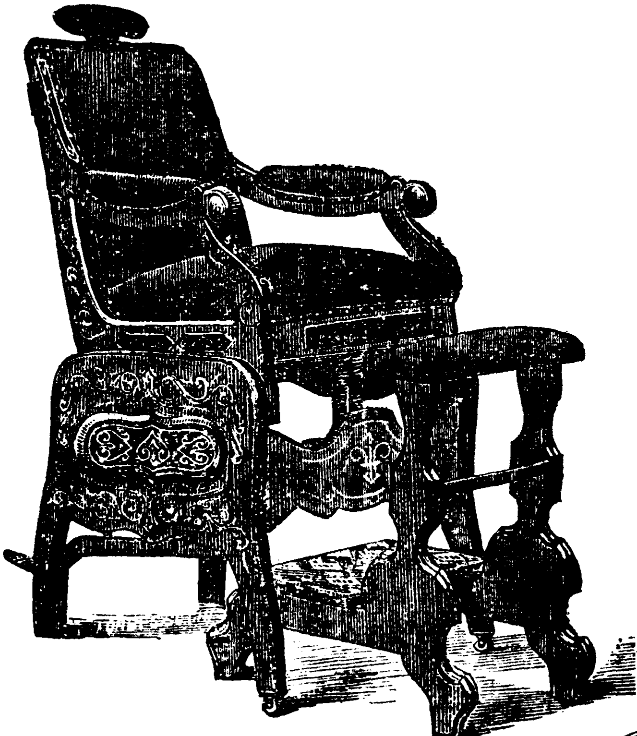
The Sewing-Machine.—The sewing-machine first appeared as a practical invention about thirty years ago. Thimonnier, the real originator of the idea, was a Frenchman, and, like too many great inventors, he did not live to enjoy any part of the fruits of his genius. Elias Howe, who followed Thimonnier, was an American working artisan, and found his first real support in England about 1847. At the present time, that is, about thirty years after the establishment of the invention, there are upwards of 4,000,000 sewing-machines in use in various parts of the world; and the annual number of new machines produced in this country is estimated at 80,000, employing about 100,000 persons. In France, Germany, and Belgium, the production of machines is very large, and in the United States the annual number turned out is perhaps greater than in the whole of Europe. In 1862 it was estimated that in the United States each machine saved to its owner $10.50 a week, or say $650 per annum, in wages alone, or an aggregate saving in wages, for the whole country, of about $50,000,000. In 1875 the aggregate saving had risen to $500,000,000.

As the general result, Mr. Plummer says that "taking all various industries in which the machine is used, the wages of the machinists may be estimated as being from 50 to 100 per cent. *higher* than the wagers received by hand-workers before the machines appeared in several industries." And he goes on to add: "The changes introduced by the machine have been with considerable advantages as regards the physical and social condition of the workers. There is a great improvement in their health and in the comfort of their homes. As regards the shoemaking population, both male and female, the change amounts to an absolute revolution, and decidedly for the better."

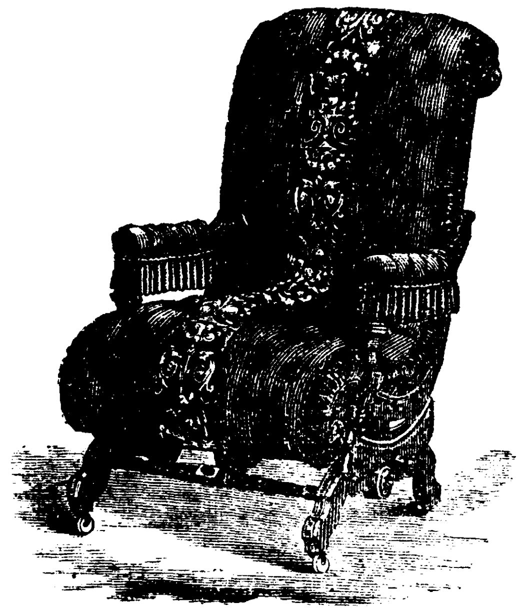
The sewing-machine has most effectually stimulated invention in other directions. In all leather manufactures, for example, the old, painful, unhealthy processes are now nearly all done by machinery driven by steam. In the stay and clothing trades the severe labor of using heavy shears by hand is superseded by steam-driven cutters, by the aid of which one man does the work of twenty. The cheapness arising from these appliances has so enlarged the demand that the quantity of labor employed in these trades is far greater than before.—*Popular Science Monthly.*

Inland Sea in Algeria.—MM. Dumas and Daubree have urged several objections to the proposed artificial inland sea in Algeria, and agree with M. Naudin, who read a paper on the subject at a recent meeting of the Academy of Sciences, that its sanitary effects would be deplorable. It is thought that to fill the shallow basins of the region which it is proposed to convert into a sea with salt water would be equivalent to reproducing in Algeria all the worst features of marshy plains. Captain Roudaire, who proposed the scheme, admits that even in the centre there would nowhere be more than about 80 feet of water, and the whole coast line would have so little water that it would be little better than a sand-bank with an admixture of salt and fresh water, upon which the strong tropical heat would act in the most deleterious manner for two-thirds of the year, causing a rapid decomposition of organic matter, and spreading contagion for miles in every direction. M. Naudin considers that there is no similarity between this district and Egypt, the climate of which country has been much improved by the creation of the Suez Canal and the plantation of trees; for, according to him, while Egypt lies between two seas, and is traversed by an immense river which has periodical overflows, the Algerian district is far from the sea, and is bounded by arid deserts.—*The Engineer.*

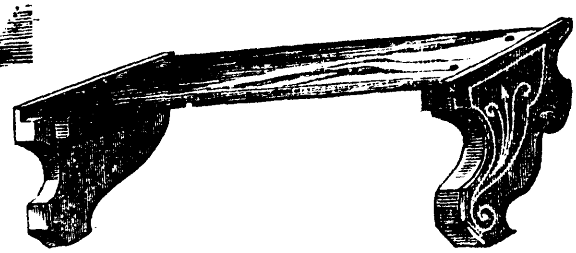
Colossal Balloon at the Paris Exhibition.—Among the objects of interest at the Paris Exhibition of 1878, will be a monster captive balloon. It will be 16 feet higher than the Arc de Triomphe. It will be strong enough to carry an engine and its driver; it will hold 50 persons at one time, and raise them to an elevation of more than 1,600 feet. It will be made of alternate layers of silk and India-rubber, which will be joined together by more than 3¼ miles of cotton. The balloon will be held captive by cables capable of resisting a strain of 10,000 kilogrs.—*Manufacturer and Builder*, ix, 197.

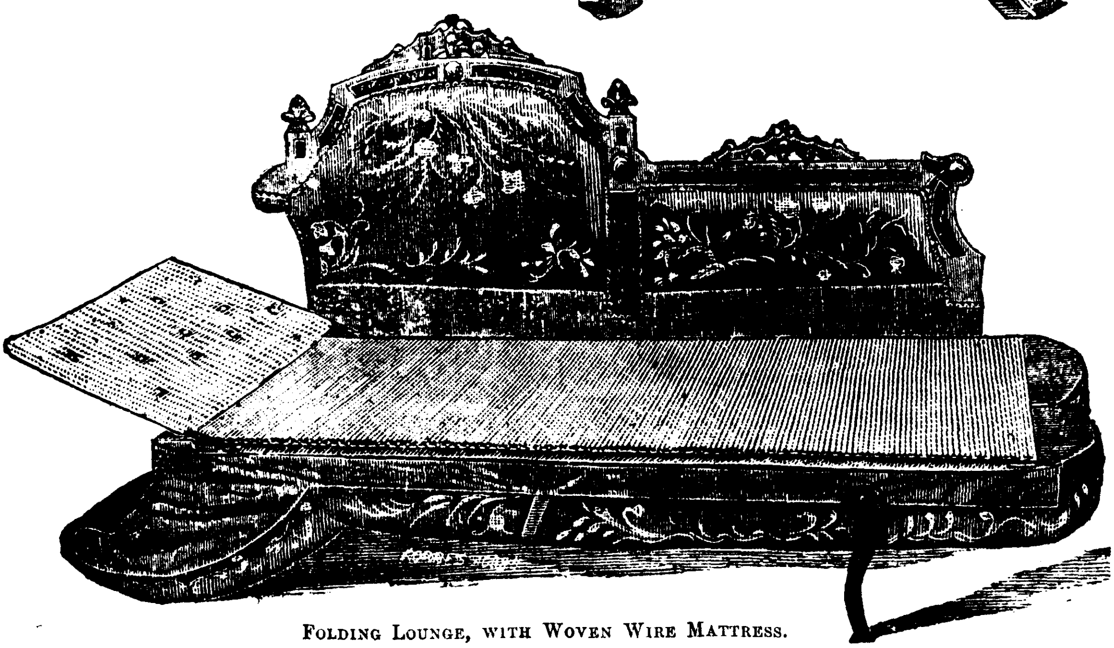


ANGLE'S PATENT BARBER CHAIR.



CARTER'S PATENT ROCKER.





FOLDING LOUNGE, WITH WOVEN WIRE MATTRESS.

FURNITURE DESIGNS.

FROM THE AMERICAN CABINET-MAKER.

Cut showing an arrangement for fastening the feet on lounges without glue. The feet are all blocked, making them stronger and more firm than by any other means.

WOOD CARVING.

There has been a revival of the art of wood carving in the city of Cincinnati, and the work is largely done by amateurs. A correspondent of the *Evening Mail*, of this city, gossips cleverly on the subject, and we quote a part of his letter.

HOW ANY ONE MAY LEARN WOOD CARVING.

It is not proposed to insure even a comparative knowledge of the art without instruction. Yet it is in the power of any person to acquire so much as to employ many an hour with great entertainment and fair results. It will be understood at the outset that it is very much to the advantage of students if they know even ever so little of the art of drawing. And, indeed, if one wishes to execute original designs or copy from natural forms, the knowledge of drawing is a necessity. But if nothing of this has been acquired, it is possible to trace the design from photographs or prints. In this way there can be obtained the forms of leaves of trees, vines, flowers, fruits, and a great variety of arbitrary and conventional forms. Red or white chalk can then be rubbed over the lines upon the opposite side of the tracing paper. Let this be placed on the wood to be carved, and, with a pencil or sharp stick, follow the lines originally traced. The drawing, which will thus be faintly seen upon the wood, should be more distinctly fixed with chalk or pencil. The subsequent operation will thus depend upon the kind of carving to be done. If it is "diaper," "relief," or others, different kinds of tools are employed.

The visitor at the School of Design, in this city, may, any day or hour of the day, see ladies robed in calico work dresses seated in groups busily employed in talking and working. In their hands are parts of brackets, book-cases, book-racks, card receivers, paper knives, picture-frames, parts of work-boxes, book-covers, and so on. The tool most commonly used for this work is a sort of knife which has a grooved blade, by which the wood is gouged and scooped out. If more serious work is intended, the wood is placed upon a table, and, if need be, held firmly by a vise. Then come the numerous kinds of chisels, and the mallet, and heaps of chips. This heavier kind of work is not attempted to any extent at the School of Design. It is, however, easily and successively performed at "Fry's Atelier."

THE WOODS USED IN CARVING.

There are several kinds of wood used in carving. The common black walnut is the favorite material, because its grain is for the most part straight, its texture neither too hard nor soft, nor is it too brittle. It also absorbs the two or three coatings of oil which complete the final finish of the work; for, be it very decidedly understood that we reject as vulgar and unartistic the hard glitter of varnish.

Oak is a popular wood for carving purposes, but it is tough to the chisel, it does not easily absorb the oil, and it requires a century or more to give it a deep, rich tone.

Besides these two, there are the wild cherry, with its superb color of dark sherry wine, with ebony and rosewood. Most other woods are either badly grained, spongy in texture, or otherwise unfitted for the tools of the carver.

WHAT AMATEURS CAN DO.

I could, were it proper, give you the names of a number of ladies of our city who have executed most admirable specimens of carved work. There is one young gentleman here who, for several years, has pursued this art as the occupation of what few leisure hours are permitted him from the laboring and successful practice of the law. During this time he has furnished his own offices with book-cases, desks, and tables, tasteful in form, firmly built, and enriched with admirable carvings. In his own house he has placed armoires and book-shelves which are most elaborately and artistically ornamented with carved work. To return to the text which has impelled this letter, surely it is better that the "idle rich" should have the opportunity of knowing how much pleasanter and more profitable it is to be engaged in artistic work, such as has been described, than kicking their feminine heels (in the case of women) in the agonies of *ennui*, or rushing across the ocean in search of the excitement of life in Paris.

EDGE-LAID BELT.—A better plan of making a broad belt than the usual American *double* leather belting sewn together, is made with the greatest ease, of any thickness or width, perfectly equal in texture throughout, and alike on both sides. It is made by cutting up the hides into strips of the width of the intended hickness of th e belt, and setting them on edge. These strips have holes punched through them about one-eighth of an inch in diameter and one inch apart. Nails, made of round wire, clinched up at one end for a head and flattened at the other, are used for fastening the leather strips together. Each nail is half the width of the intended belt, and after the strips are all built upon the nails, the ends of the latter are turned down and driven into the leather, thus making a firm strap, without any kind of cement or splicings. When the strap is required to be tightened, it is only necessary to take it asunder at the step lines of the spice, cut off from one end of the strap at each step what is required, and piece up again with wire nails or laces, going entirely through the strap.—*E. Leigh.*

BORACIC ACID FOR SKIN DISEASES.—Surgeon-Major Watson reports in the India *Medical Gazette*, that he has lately employed boracic acid with very great success as an external application in the treatment of dermatophyta, or vegetable parasitic diseases of the skin. He was, it appears, induced to try this remedy from witnessing its employment as an antiseptic in the Edinburgh infirmary wards. The diseases in which he has hitherto used boracic acid have been the various forms of tinea, especially that very troublesome form of the disease which affects the scratum and inner sides of the thighs of many Europeans in India. Dr. Watson declares that the external application of a solution of boracic acid acts like a charm in such cases. An aqueous solution of boracic acid of a drachm to the ounce, or as much as the water will take up at ordinary temperature, is employed. The affected parts, he says, should be well batbed with the solution twice daily, some little friction being used, and it should not be wiped off, but allowed to dry on the part. Altogether, he regards it as preferable to all other remedies of the same class.

A NEW industry has been introduced in France—the breeding of ants for their eggs. These eggs are sold to the breeder of pheasants. As yet the business is in the hands of its originator, a woman, and she already appears to be on the high-road to fortune.

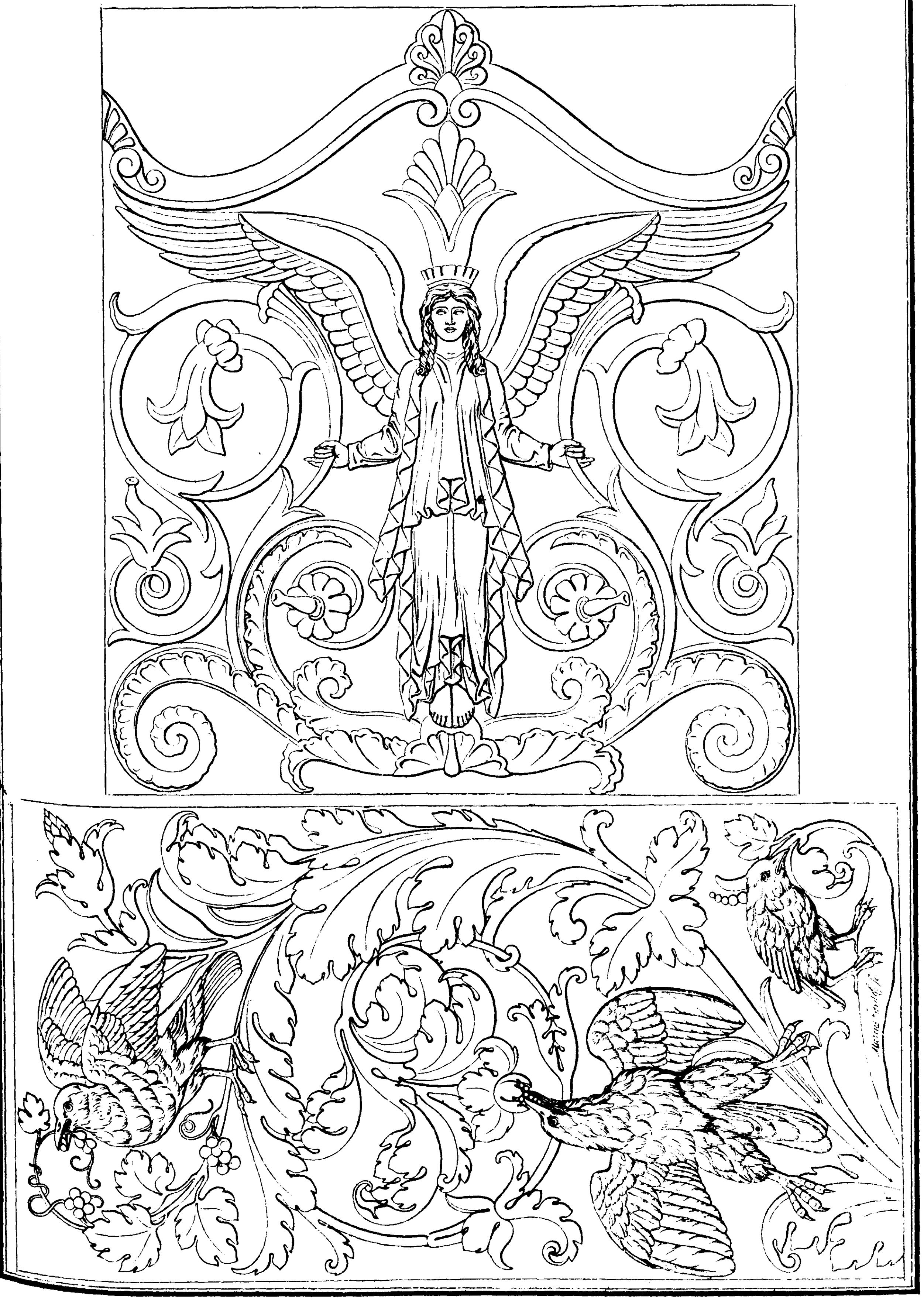
RED INK.—Attention is called to the new color Eosin (*Druggist's Circular*, 1876, pp. 42, 131, 171; it gives a fiery red or soft rose-leaf color, according to the strength of the solution, without the least admixture of blue-shade, which makes the fuchsin ink so vulgar looking. It is rather expensive ($1.50 to $2.00 per oz.); but this is compensated for by its great tinctorial power—four grains per fluid ounce being rather too strong. By the way, aniline inks are improved in fire by using a decoction of quillays bark (say one in twelve) instead of water to dissolve them in.—*D. C.*, xxi, 67.

PAPER LACE.—The perfection in machinery, and the novelties introduced thereby, find illustration in a recent occurrence at Berlin. A lady purchased for some relatives two silk ties, with lace borders, which were generally admired, until it was discovered that one of the ties was bordered with real lace and the other by paper lace of similar pattern. The *Papier Zeitung* says that this is rather a matter of congratulation for all parties interested in the development of paper manufacture. The article in question was so wonderfully pressed, and of such beauty, that it was very deceptive.

A FRENCH authority recommends the use of sawdust instead of hair in mortar to prevent its peeling off. His own house, exposed to prolonged storms on the seacoast, had patches of mortar to be renewed every spring, and after trying without effect a number of substitutes, he found sawdust perfectly satisfactory. It was first thoroughly dried and sifted through an ordinary grain sieve to remove the largest particles. The mortar was made by mixing one part cement, two lime, two sawdust, and five sharp sand, the sawdust being first well mixed dry with the cement and sand.

PIVOT TEETH IN DENTISTRY.—Among the best of the inventions in the way of pivoting is a device of Dr. Bonwill's. The root being cut down, the pulp-canal is reamed out greatly in excess of the size of the pivot that is to occupy it. A pivot made of platinum wire, upon which a screw is cut, is next fitted into the canal, and firmly packed into place through the use of amalgam. When this amalgam is set, the tooth—the pivot hole running through it—is placed upon the pivot, and is screwed solidly into place by means of a delicate nut, made of gold. It will be understood, of course, that the fitting of the tooth in position has been done at the time of setting the pivot into the root. This operation, when well accomplished, holds a pivot tooth so firmly in place that it may be used with the utmost freedom in mastication.—*Scientific American*, xxxvii, 117.

EXAMPLES OF FREE-HAND DRAWING.—(*From Vere Forster's Work.*)



THE TUNNEL UNDER THE ENGLISH CHANNEL.

The London *News* says: "At Sangatte, near Calais, shafts are being driven downward to the depth of 100 metres below the sea, in order practically to test the possibility of the above gigantic undertaking. More than a year ago we reviewed at some length the plans of the proposed subway, and on Jan. 22, 1875, a carefully-prepared chart, showing the locality of and the course to be taken by the tunnel, appeared in the *Daily News*. At that time the scheme deserved only to be examined theoretically; but now that the preliminary works have been commenced, the chances of the completed tunnel becoming, as its promoters expect it will become, the way, *par excellence*, between England and the Continent, become practically interesting. Capt. Hotham, her Majesty's Consul at Calais, in his report for the year 1873, remarked that he had great confidence that a submarine way would eventually be constructed. 'In which case,' he added, 'the question as to the best kind of vessel to be employed will be set at rest, and breakwaters, dredging machines, narrow harbors, floating sands, and *id genus omne* will be things of the past, as far at least as the international communication in this channel is concerned.' Here we have a reminder of the difficulties that at present beset the maintenance of speedy and regular communication between England and France, and, at the first blush, it seems to be beyond a doubt that if the tunnel can be satisfactorily completed, it must take to itself much of the traffic that now passes over the old routes. But it must be remembered that the character of the old routes is somewhat altered by a Castalia, and that the class of vessels soon to be built will be able to travel almost as fast as a railway train, and almost as steadily as a Pullman car. If the Castalia is improved upon, the problem of international transit must resolve itself into a fairly-matched struggle for supremacy between open-air and submarine travelling. The two methods will be about equally fatiguing and of nearly equal duration, and, as far as passengers are concerned, the question in five years' time will be one of preference simply. To severe critics of the tunnel project it does not appear probable that a healthy traveller should prefer to journey in a tunnel when he can progress as surely and with greater comfort in the open air. It does not seem to them likely that a man whose wish is to go from Dover to Calais should care to travel in a hot carriage through some thirty miles of damp, close atmosphere, when close to the pier, as he starts, is a vessel that will not roll, that will carry him as speedily as the train, and that will not confine him and poison his lungs with carbonic acid gas. But to those critics the horrors of sea-sickness are evidently unknown. As regards speed, the two routes, we may allow, would be very nearly equal; and as regards comfort, the sea route would to many carry the palm. The average length of sea-passage between Dover and Calais, even at present, is under an hour and a-half, and a train on slippery rails in a tunnel, six miles of which has an upward gradient of one in eighty, could scarcely perform the distance in much less time. To good sailors, a steady vessel would be superior to a railway carriage in a burrow thirty miles in length, and as to cheapness, the Channel Tunnel, in order to be a success, will have to pay interest upon £8,000,000, at the very lowest estimate, and, almost certainly, upon a good deal more, and consequently the tariff would be high. If the tunnel monopolized even as much as half the actual passenger traffic from England to the Continent, and *vice versa*, would the results be particularly favorable? At the present time about 400,000 persons travel annually across the Channel, and at 10s. per head, half of these would only give a gross passenger revenue of £10,000. An official statement, printed for the Channel Tunnel Company, after dealing hopefully with the statistics relating to passenger traffic, adds:

"'As to goods, the receipts would no doubt be very important. London is the seaport of all the world, receiving and sending forth enormous quantities of all kinds of goods In regard to many articles of merchandise, and in a great many cases, it will be more advantageous to transport them by railway through the tunnel than to ship and unship them. No doubt the goods on which the higher freights are paid, and which now go through the ports of Boulogne, Calais, Dunkerque, Ostend, and Dieppe, to or from England, would go through the tunnel. This alone would be a heavy traffic. The quantity of goods passing between England and the Continent through those ports is enormous. It does not consist solely of fancy goods and manufactured articles, but also of grain, wine, fruit, vegetables, and dairy produce. For many of these things the cheapness of water carriage would be more than counterbalanced by speed of transport, certainty, and even decreased cost of packing.'

"This train of reasoning doubtless contains the secret by which the tunnel is to be made to pay, if it does pay, fair interest upon £8,000,000 of capital. But the question arises, whether it would be worth the extra expense to send any of the goods specified, except fruit, vegetables, and, perhaps, dairy produce, via the tunnel? And would the fruit, vegetables, and dairy produce, even combined with the two hundred thousand passengers, bring in sufficient to pay the working expenses, and the necessary dividends? Considering the enormous sums that must be sunk before the Channel Tunnel can earn a penny, these few considerations should be attentively regarded. While admiring the pluck that suggests the enterprise, and the devotion that animates the promoters, and particularly the engineers, of the work—nay, even while supporting the undertaking as a monument of ingenuity and resource, we hold back from expressing any decided opinion, as to whether the work will ever pay—as to whether, in short, a satisfactory proportion of the eight millions invested, or to be invested, will be returned in the form of dividends."

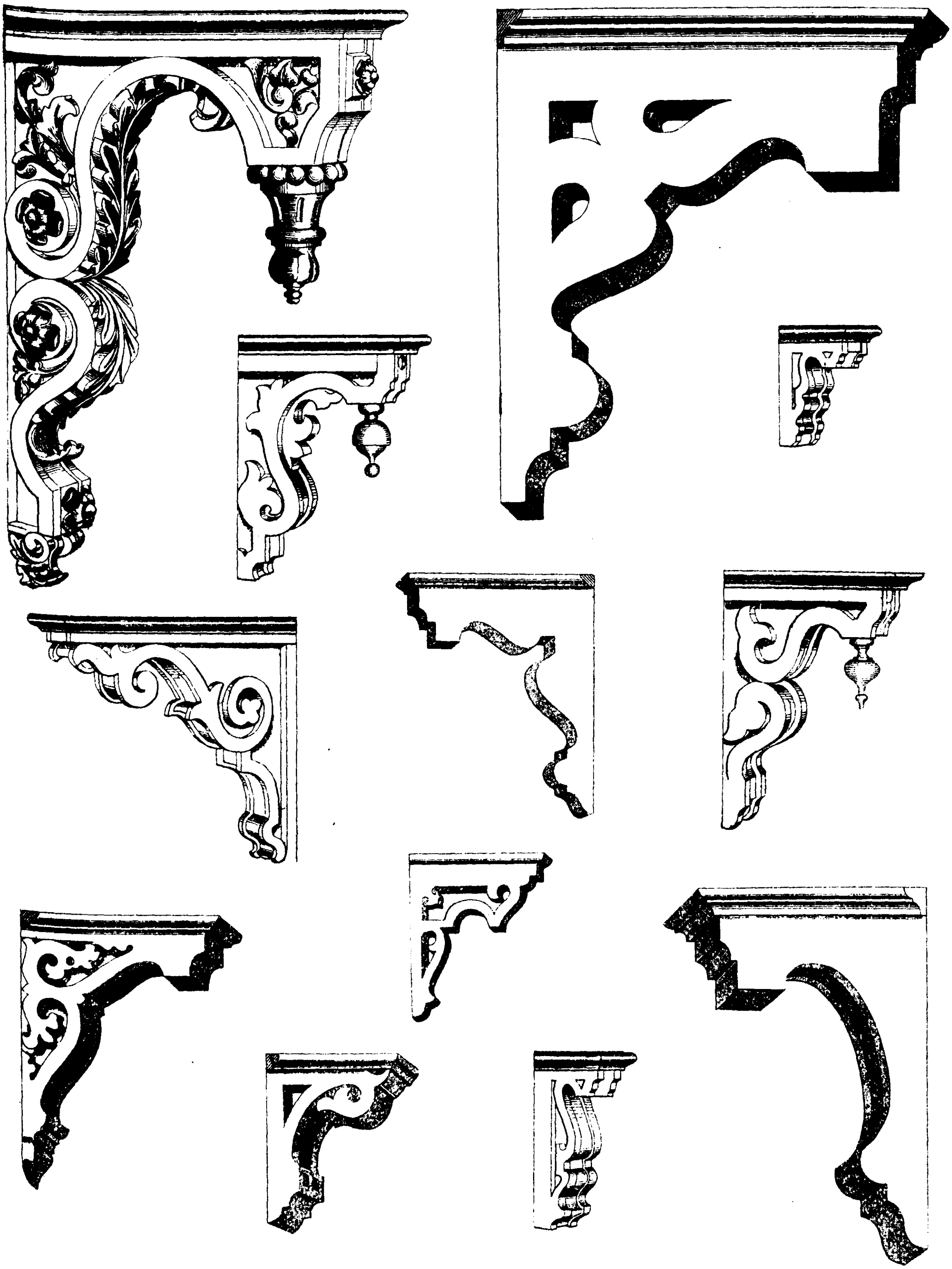
A New Ventilating Apparatus was exhibited at the recent show of the Royal Agriculture Society, invented by Mr. C. S. Hall for a special purpose, by passing noxious gases, vapors, and fumes to the chimney, or furnace, or condenser for decomposition. A Baker blower is placed on the roof, a jet of air is forced through into a large tube which connects with the chamber below, and by induction takes up and carries to the condenser without passing through the blower.

USEFUL RECIPES FOR THE HOME AND SHOP.

Golden Varnish.—Pulverize 1 drachm of saffron and ½ a drachm of dragon's blood, and put them into one pint of spirits of wine. Add 2 ounces of gum shellac and 2 drachms of Soccotrine aloes. Dissolve the whole by gentle heat. Yellow painted work, varnised with this mixture, will appear almost equal to gold.

Bronze Ornaments.—First varnish the work to be bronzed, and allow it to dry until it is "tacky," then lay on the pattern (which should be cut in good foolscap paper,) and apply the bronze (dry) by means of a small velvet cushion; allow the coat to become thoroughly dry, and then varnish again.

Quickly Drying Glue.—Put your glue into a bottle two-thirds full, fill up with common whiskey, cork tightly, and set it by for two or three days; it will dissolve without the application of heat, and will keep for years.



A PAGE OF CORNICE BRACKETS.

Mixtures for Tempering Small Steel Articles.—By mixing 4·75 quarts sperm oil with 4 pounds tallow and 1·4 pound wax, we obtain an excellent material for tempering small steel articles of any shape. By adding 1 pound of resin the mixture will also serve to temper larger articles. The addition of the resin must be done with great care, since if too much is used the articles tempered will become too hard and brittle. After some months' use this mixture loses its value, and when replaced, if the same vessel is used, care should be taken to thoroughly cleanse it of all the old mixture. Another mixture which has been found useful in practice, is composed as follows: 95 quarts spermaceti oil, 20 pounds tallow, 4·75 quarts of oil from beef fat, 1 pound pitch, and 3 pounds resin. The pitch and resin are melted together, and when thoroughly incorporated the other three ingredients are successively added and the mass heated in an iron vessel until all the water has been driven off by evaporation. So much of the mass as is not for immediate use should be kept in hermetically sealed vessels. The use of these mixtures in tempering is as follows: Scythe blades, for example, are heated to the proper temperature and thrust into the oil bath, where they remain until nearly cold. They are then taken out and lightly rubbed with a piece of leather, leaving a thin film of the mixture upon the blades. They are then passed over a light coke fire and heated until the oil takes fire and burns. When hardness is required, only a part of the oil should be burned off. After this the blades are heated to a straw color, which disappears upon immersion in a bath of hydrochloric acid and a subsequent washing in clean water.—*Annales du Génie Civil—per Metall. Review*, i, 100.

The Rain-Tree of Peru.—Accounts from Peru bring the intelligence that, in the forests near Moyobamba City, a tree has been discovered called by the Indians "tamia-caspi," or "rain-tree," which possesses remarkable properties. This wonderful vegetable production, observes the *Colonies and India*, we are told, absorbs the moisture of the atmosphere, which it concentrates, and subsequently pours forth from its leaves and branches in a perfect shower, and in such quantity that in many cases the surrounding soil is converted into a bog. We are further informed that it possesses this singular power to a greater degree during the hot dry weather, when the rivers are at their lowest and the water most scarce. It has been suggested to the Peruvian Government by a gentleman who has examined these trees that the experiment of their culture in the more arid parts of that country should be made, with a view to the benefit of agriculturists.—*The Engineering and Mining Journal*, xxiv, 183.

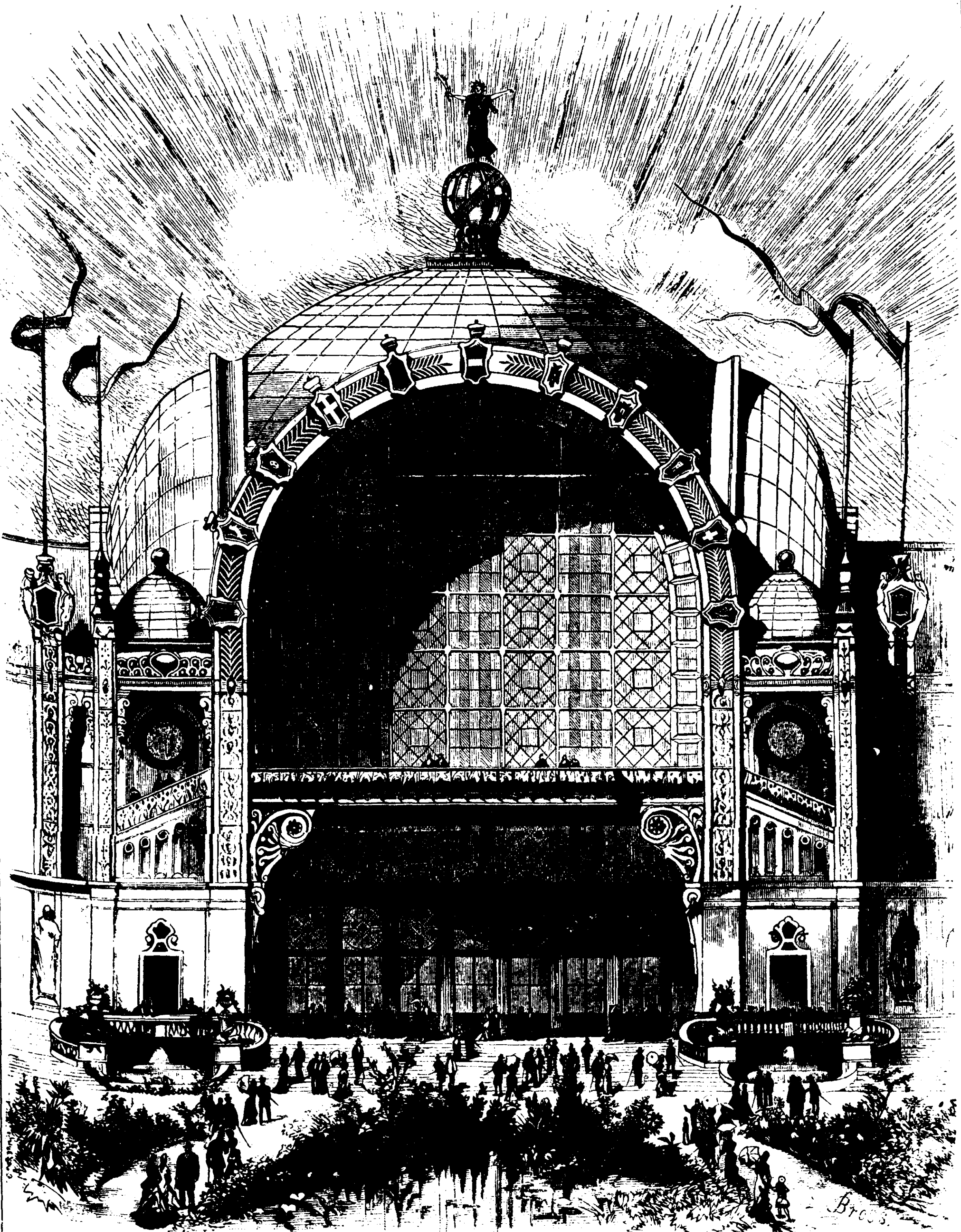
The Antiseptic Properties of Boracic Acid.—The antiseptic properties of boracic acid for the preservation of organic matter have again been tested by G. Polli of Mailand, partly by personal observation and partly in large hospitals. The same experiments were made with the alkaline sulphides and phenole. He found that for the preservation of beer, milk, eggs, urine, and defibrinated blood, boracic acid was much more effective than the sulphides and equally so with phenol. Also as a disinfectant of wounds and a deodorizer boracic acid can be advantageously employed.

The Penetration of Flow of Air and gases through walls of building and even of stone, with wonderful facility has been shown by experiments by Professors Märker and Schultze.

Valuable Mineralogical Discoveries in Canada.—Prof. Vennor, Geological Surveyor, who is exploring the regions of White Fish, Pemchange, and St. Mary's Lakes, on the Upper Gatinian, reports the discovery of an immense mountain of pure crystaline phosphate of lime, showing on the surface hundreds of thousands of tons which will yield 90 per cent. He thinks it is the junction of two great belts running up the Lievre and Gatinian rivers. He believes the Lake Superior silver-bearing rock runs across the head waters of the Gatinian Rivers. He reports, also, the discovery of a reef.—*Eng. & Mining Jour.*, xxiv, 172.

A New Use for Tadpoles.—The help of aërial insects is sometimes called in to produce skeletons of small vertebrate animals. But these skeletons generally rather dirty, and one can imagine how it would be better if the operation could be performed under water by means of aquatic animals. This has, indeed, been done at the sea-side, which, however, is not always accessible. M. Lareste has discovered a process which should become general. Tadpoles, he finds, are not (as has been affirmed) phytophagous, or exclusively plant-eating. They eat organic matters belonging to both the kingdoms, preferring those which are getting into putrefaction. It is possible to habituate them, in a few days, to live exclusively on flesh, without injury to their robust appetite. They will then clean marvellously the bodies of small animals given to them. M. Lareste has shown the Linnæan Society of Bordeaux excellent skeletons of three kinds of lizard, three kinds of snake, two kinds of triton, and a larva of triton, obtained in two hours, the latter being quite an anatomical *tour de force*, considering the extreme softness of the bones of larvæ of batrachians. The operators were a hundred tadpoles of frogs (*Rana fusca* and *Agilis*). The number of tadpoles should be proportioned to the task, and the small animal should be given them skinned. The skeletons should be completed in two to three days at the most, so that the water may not destroy the ligaments. You dress them when still wet, and coat them with a preservative liquid (Smith's or another). The tadpoles should be kept in half darkness, and in a warm place, for they are not very voracious if it becomes cold. It is very easy to procure tadpoles in the country, and the process described should furnish a popular recreation.—*English Mechanic*, xxv, 133.

Tinning Thin Cast Iron.—In tinning thin cast iron goods they run the risk of losing part of their substance by the filing or friction necessary for the removal of the oxide with which they are coated, or of twisting out of shape in the furnace if the oxide is removed by heat. They run the same risk from heat employed in the ordinary process of tinning. Where it is of consequence to avoid these evils, the first may be obviated by scouring with sand and a solution of 2 parts sulphuric acid in 8 of water until the rust vanishes. The goods are then washed with rain water and set in a solution of 1 part sulphate of copper in 8 parts water. Here they are left till they have become coated with a faint red coating of copper, which is cleansed with sand and water. They are now brushed with a solution of chloride of zinc and dipped at once into the melted tin. If it is desired to give brilliancy to the tinning, the goods are again dipped, the second time in a second vessel, the molten tin in which is covered with a layer of tallow. The tallow prevents the tin from oxidizing during the operation, and the goods come out bright. The coppering of the goods before tinning, facilitates the latter operation, which may be conducted at a heat such that the goods run no risk of warping.—*Iron* x, 195.



THE VESTIBULE OF THE PARIS EXPOSITION BUILDING.

Transmitting Power Long Distances.—Prof. Osborne Reynolds, delivered a long and valuable address before the Manchester Scientific and Mechanical Society, on the transmission of power long distances. He analyzed all the means proposed, carefully, and arrived at the following conclusions. Twenty miles appears to be the outside limit to which power may be economically transmitted, even when the power can be had for nothing, and the most enonomical means of doing this, is probably the wire rope. This review, therefore, shows the hopelessness of our ever utilizing the natural sources of power, such as tidal rivers for mechanical purposes, unless we conduct them on the banks of those rivers. But as regards the substitution of a general source of power for the small steam engines now in use in our towns, the case appears more hopeful; and, what is more, this has already been done in some instances. In the most notable instance, that of Schaffhausen, the power is obtained from the Rhine, at a point close to the town, and is conveyed along the banks of the river, which crosses the ends of the streets of the town, by a wire rope, which, as it passes the ends of the streets, gives motion to shafts which are laid in a channel under the pavement, and from which the power can at once be introduced into the various manufactories. In our own country, also, in the town of Hull, I believe that pipes have been laid down to convey the power derived from steam in the form of water, under a pressure of 600 pounds, over some part of the town. It does not appear unreasonable, therefore, to suppose that something of the same sort might be done in our own city. Considering that a very large proportion of the power required in our warehouses is for hydraulic presses, it would appear desirable that, in part at least, the power should be communicated to water pressure. Where rotatory motion is required, the machinery might be driven by pressure engines, but as this would entail considerable waste, and as power may be more cheaply conveyed by compressed air, it might be better to supply both water and air; as regards the mechanical means, ropes and shafts. Although the former appears on the whole to be the most economical means of communicating work, and to a certain extent, their superiority is supported by the instance of Schaffhausen, considering their inconvenience in a town, I think that the pipes would be preferable. With the ability to have either water or air at the most convenient pressure, and at a reasonable cost, I think that but few users of power on any but the largest scale, would care for the trouble, danger, dirt and expense of having steam engines of their own; and if this be so, there would then be a chance of reducing the impurities in the air. Looking at these facts, I cannot help thinking that there is open to the engineer a field of enterprise, in which he may not only find remunerative employment for his talents, but in so doing confer a great benefit on his fellow creatures. This may not be so. The scheme, when closely considered, may be found wanting, but it will have served my principal purpose if it has helped to illustrate and render interesting what would have been otherwise desultory remarks about the transmission of work.—*M. & S. Press*, xxxv.

Imitation Leather.—The latest thing in the shoe and leather trade is "imitation leather," to take the place of skivers, sheepskins, roans, etc., as lining for shoes, carpet-bags and lambrequins. The article is composed of heavy cotton cloth, made especially for the purpose, and covered with a series of coats of chemical substances which give it the appearance of leather; and so much does it resemble the ordinary leather lining used for the same purpose that very few, even old shoe manufacturers, have been able to detect the difference between the real article and the imitation, while it is asserted that the latter possesses several points of superiority over the former from the fact that it is much more durable, can be worked up in an easier and more economical manner, is considerably cheaper, and can be used for all purposes of lining, except in shoes made from leather containing large quantities of oil. Its color, also, (the article is manufactured in every imaginable color that can be desired) is said to be firmer and more uniform than that of kid or sheep linings, and is never affected by heat, cold or moisture.

"Imitation leather" was only introduced three or four months ago, and until the present time the manufacturers have made no especial attempts to advertise it or push it into notoriety, but it is reported to have given great satisfaction wherever it has been used, and attained considerable celebrity upon its own merits in different parts of the country, and the demand for it has now become so large that the manufacturers have been obliged to establish a special factory for its production, with facilities for manufacturing upon a very extensive scale.—*The Manufacturer & Builder*, ix, 203.

In Treating of General Principles of House Draining, Mr. T. M. Reade, C. E., remarks that in the selection of materials for drain there is a choice. The use of glazed fireclay or earthenware pipes is almost universal. The architect should insist upon a strong, well-turned material, accuracy in form, true sockets and a good smooth glaze. Pipes having a rough interior should not be used. The true laying of a pipe is of more importance than its quality. Levels must be accurately taken and sections made cannot be too strongly insisted upon; this trouble will be amply repaid in the quality of the work. A fall of 1 inch in 48, or ½ inch to a piece, is a very good one for a main drain.

Pressed Bricks are made from blast furnace slag and the following materials in Germany. To the powdered slag 42 per cent. silicic acid, 37 per cent. gypsum, 10 per cent. clay, 5 per cent. oxide of iron, 3 per cent. magnesium, 1½ per cent. sulphur, and various other materials mixed with lime are added. The mixture is given the common brick form in a steam press, and after drying in the air for three months are ready for use. The daily production of the presses are about 8000 bricks.—*Engineer*, xliv, 151.

New Use of Sour Milk.—A new industry has been started in Mansfield, Mass. It is no less than the manufacture of jewelry out of sour milk. This seems a strange anomaly, but it is a fact. The milk comes in the shape of curd from butter and cheese-making counties in New York, and looks, upon its arrival a good deal like popped corn; but before it leaves the shop it undergoes a wonderful change, and receives the name of African coral. The secret in making it up is carefully guarded, but it is certain that it has to be heated very hot, during which coloring matter is introduced, followed by a very heavy pressure. Some of it is colored black and called jet, while some appears as celluloid. It makes very handsome jewelry, and is made into all kinds and styles known in the trade. —*Scientific News*

New Tanning Process.—Charles Paesi, an Italian chemist, recently discovered a new mode of tanning, which is stated by the *Journal d'Hygiene* to be much superior in its results, as well as more expeditious, than any mode in which tan bark is used. It consists in macerating the skins in a bath of perchloride of iron and sea salt dissolved in water. The operation lasts for from four to six months. The perchloride is a powerful disinfectant, and is said to render the industry much more healthy than it now is—*Eng.*, lxv, 21.

CLEFTRIDGE SPAN, ERECTED OF BETON COIGNET, IN PROSPECT PARK, BROOKLYN, N. Y.

The Cleftridge Bridge.

The city of Brooklyn, N. Y., can boast of possessing, in her beautiful Prospect Park, one of the most elegant and elaborate structures of the viaduct class in the world, namely, a single-span serving to pass the foot-path under the carriage-road. It is represented in the to the width of the Breeze Hill drive over it, namely, 88 feet. This archway enables visitors, turning from the main entrance, to reach the concert ground and lake shore on foot at an easy grade and by a protected line of approach.

We ought to state that the beautiful design is due to Mr. Calvert Vaux, and that it gave the manufacturers of the stone a splendid opportunity to prove how well their material is adapted for decorative purposes, by the facility it offers for the introduction of ornamental details, because after a design for recurring ornaments is once well modelled and prepared for carving, it can be repeated by casting over and over again, with ease.

Steam-Power is to be tried upon the Penn avenue line of street cars, in Pittsburgh, Pa. Mr. H. E. Marchard, of that city, recently received a contract for the building of a double engine of compact form, 18 horse-power and double cylinder. This engine is geared directly to the forward shaft of the car, while power is communicated to the rear shaft by endless chains and toothed gearing. The cylinders are 7 x 8 inches, and adjoined engraving. and was estimated to cost, in stone, $250,000—almost a quarter of a million; while a plain brick arch of the same size would have cost about $40,000. It was then suggested to have it made of Beton Coignet by the N. Y. Stone Contracting Co., of Brooklyn, N. Y., who, in the winter of 1871-72, erected the whole structure for $20,000, and this under the most trying circumstances. These simple facts are one of the best arguments in favor of this kind of material, the other arguments being its elegant appearance (evident from the engraving) and its durability.

This bridge has for seven years been subjected to severe winter frost, moisture, dryness, etc., without the least impairing results. The carriage-road goes over the same, while under the arch the foot-path is laid with an ornamental pavement, also of Coignet stone. The arch is 20 feet span, and in length equal precision, and little cost.

It should be remembered that in the architectural treatment of archways for park purposes, the most serious difficulty lies in the arrangement of the soffit or ceiling, the surface of which is always so large that its elaboration in brick, stone, or wood, if made ornamental, is so expensive from the labor required that it is only admissable in exceptional cases. It is therefore important to be able to make, at a moderate expense, an elegant and ornamental soffit, as in fact it is as it were the key-note of the whole design. This has been very successfully accomplished in the Cleftridge span, which is a model worthy of imitation, and we have no doubt that our readers will appreciate the beauty of the design, our engraving being a correct representation of its appearance after completion, being copied from a photograph taken on the spot.

Draining the German Springs.—Much excitement has been created at Ems, in Germany, the most famous of Continental watering places, by the threatened destruction of the baths which are its main dependence. The mining companies working in that neighborhood are undermining the springs. The mines formerly supplied lead and silver only, but since the extension of the manufacture of steel, the gangue rock—which is a carbonate of iron—has become more important than the other parts of the ore. The fact seems to be that the increased activity given to the operations by this new source of profit has led to excavations to a depth which may really interfere with the natural water courses of the region. Such a result is by no means new in mining, for, frequently, wells and springs dry up when the shafts near them are sunk to a great depth. Sometimes the mine is the sufferer from the mishap, as was the case with the famous Rammelsberg copper mine. The discovery of a very rich vein in one portion of the workings was followed by the drying up of the wells in Goslar, a town of 10,000 inhabitants, situated two or three miles from the Rammelsberg shafts. The managers were obliged to wall up their rich stores and forego the benefit of working them. At Ems an investigation has been ordered, but as yet the result has not been reported, so that, for the present, it cannot be determined whether the baths or the mines are to be the sufferers.

Case-Hardening.—*Polytechnic Review:* In case-hardening iron to a considerable depth, the unhardened portion is weakened by crystallization. This difficulty may be completely remedied by first hardening as usual, then annealing the articles the same as if of steel, in which operation the iron will assume its original fibrous structure; then harden, and, if required, temper the same as steel.

Spontaneous Generation.—An interesting series of experiments has been conducted in London, says the *Polytechnic Review*, to decide the question of spontaneous generation; that is to say whether vegetable or animal life can start into existence itself or whether all life is but the perpetuation of life already existing. Prof. Tyndall declares the question "practically set at rest for the scientific world" in the negative. His last experiment was on the Alps, he took with him from London, packed in sawdust, 60 flasks containing infusions of animal and vegetable matter, boiled to destroy all living organisms and sealed while the fluid was still in ebullition. The necks of six of the flasks were broken by accident, and were found filled with organisms. The other 50 remained for six weeks perfectly clear and pellucid. Twenty-three of the flasks were then opened in a hay loft. The other 27 were opened at a high elevation, and on the edge of a precipice, where the air was absolutely pure and free from "spores." The two groups were then placed in a warm kitchen. The 27 flasks opened out of doors remained pure, and without any indication of microscopic life. Of the 23 opened in the hay loft 21 were instinct with life, and filled with darting, dancing minute forms. Two of the 23 remained clear.

Important Improvement in Locomotives.

On some of the narrow-gauge railroads several additional improvements have been lately introduced. Thus on the Billerica & Bedford two-foot gauge railroad locomotives are used, built by the Hinkley Locomotive Works of Boston, in which the engineer, with his cab, coal, and water tank, is in front, just behind the cow-catcher, while the smoke-stack is behind. We represent such a locomotive in the adjoined engraving, and will here give the advantages claimed for this new, peculiar, and thus far entirely unusual arrangement.

TANK LOCOMOTIVE FOR THE BILLERICA & BEDFORD TWO-FOOT GAUGE RAILROAD.

It is claimed that with the chimney behind and next to the car, the smoke and gas from the fire are thrown up above the train, and consequently do not enter the cars so much as they do when the chimney is in front. The reason for this is that the cab, in moving rapidly through the air, creates a partial vacuum behind it, to which the surrounding air has a tendency to flow, and when the chimney is in front the escaping gas and smoke from the top of it are drawn to this vacuum, which is in front of the first car. When the chimney is next to the car this does not occur, or, at least, not to nearly the same degree, because the smoke then escapes behind this rarefied air produced by the movement of the cab, and consequently the car, as it were, runs under the escaping gases, which are then drawn toward the partial vacuum formed behind the last car of the train. Mr. Mansfield, the General Manager of the Billerica & Bedford railroad, writes: "We find that our smoke-stacks, being near to the car, there is no vacuum, and all cinders are thrown over the train, so that the passengers receive none."

In the next place, the truck being some distance forward of the fire-box, the position of the engineer and fireman is necessarily between the truck and the driving-wheels, which is the steadiest part of the locomotive, and therefore the most comfortable place to ride; and as there is no flexible joint in the frame between the boiler and the tank, as between ordinary engines and tenders, the cab can be shut up in cold or stormy weather, affording complete protection to the engineer and fireman. In summer the motion of the locomotive carries the hot air from the boiler *out* of the cab instead of into it, as is the case when the boiler is in front. The cab is thus warmer in winter and cooler in summer. Reversing the position and motion of the boiler necessarily brings the cab in front, and the dome and smoke-stack behind it. This leaves a perfectly unobstructed view of the track in front, and the smoke and escape steam are behind the engineer, and therefore will not obscure the objects in front of him.

New Discoveries in the Liquefaction of Gases.

Of the thirty-six substances gaseous at the common temperature, thirty have been liquefied by cold or pressures, or both, while six had thus far resisted all attempts to liquefy them. These six gases are the elements oxygen, nitrogen and hydrogen, and the compounds carbonous oxid, nitric dioxid, and light carburetted hydrogen; and this is the statement found thus far in the text-books of chemistry, while some mention that these gases have been submitted to pressures of 1,000 atmospheres, (15,000 pounds to the square inch), and even more, without showing any sign of impending liquefaction.

Now however we see it reported in the scientific papers that Mr. Raval Pietch, of Geneva, Switzerland, has succeeded in liquefying oxygen by the combined effect of the most intense cold he could produce and the comparatively moderate pressure of 300 atmospheres. The cold he produces by the evaporation in vacuo of solidified carbonic acid, which, as well known, can be liquefied at a temperature of 85° below zero Fah. by a pressure of 6 atmospheres. If this liquid is allowed to evaporate in the air, by being suddenly relieved of the pressure under which it was formed, the escaping vapor will absorb so much heat as to freeze the remnant and cause its temperature to descend quite low, and lower still if this evaporation is accomplished in a vacuum. In a tube containing this thus solidified carbonic acid gas, is placed a much narrower tube, through which oxygen is passed. This oxygen is developed in a cylindrical-shaped generator with spheroidal ends, which can stand a pressure of 800 atmospheres. It is made in the usual way by decomposing chlorate of potash by heat, and the pressure contained is due to the forcible development of the gas, in the same way as carbonic acid is liquefied by the pressure developed by its evolution when bicarbonate of soda is acted upon by sulphuric acid in a hermetically closed strong vessel. The oxygen thus compressed to 320 atmospheres, and passing under that pressure through the narrow tube lying in the solidified carbonic acid while it is evaporated in vacuo and cooled to 220° below zero Fah., liquefies, and a jet of the liquefied oxygen was seen spurting out from the narrow tube the moment the stop-cock at its end was opened.

It is also stated that Mr. Cailletet liquefied nitric dioxid and carbonous oxid in a similar manner.

When further details reach us, we will communicate more about this discovery to our readers, which certainly is important, not only theoretically, demonstrating as it does the general law that all gases are vapors from liquids or solids, but also practically, as never any great chemical discovery has been made which did not sooner or later bare useful fruits.

A Japanese Directory.—Prof. Edward S. Morse, now of the University of Japan, in lecturing about the Japanese in Cambridge, the other evening, praised their diet of grasshoppers as extremely palatable. He described the city directory of Tokio as a much more poetical volume than people are accustomed to think directories can be; it contains, besides the names of streets and business places, the localities of pleasant walks about the city, with directions where "sweet singing insects" can be heard, the best place to see fireflies and tinted foliage, etc.

Elastic Soapstone Roofing.

Nine years ago a roof was laid of what was then a newly introduced material, called elastic soapstone, upon the roof of the South Grammar School in Manchester, N. H. This roof has not since been touched, and is still in the most perfect condition. This compound had then just been patented, and has since been most extensively employed in several localities, giving the utmost satisfaction.

The claims made for this kind of roofing, are, that it is cheaper than any other, durable, and handsome; that it will not run or crack, being unaffected by heat or cold, is perfectly water-proof, and will not take fire by sparks, and that it is quite light, being only one-fifth the weight of the tar and gravel roofs. Among the practical advantages, important to the workmen who lay it, is that it is so easily applied, and can be used on the flattest as well as the steepest roofs, and this with no more trouble than a common tarred roofing; that it can be put over old tin, while the material can be used as a superior or cement, being very adhesive in its nature. The advantages to the occupants of a house with such a roof are: Perfect reliability, absence of disagreeable smell; it does not alter the color or purity of the rain-water passing over it; it forms an excellent walk, superior to anything else, while if it is desired to paint it, it can be painted any color.

We have before us numerous testimonials signed by hundreds of parties who have this material in use, and all unite in the expression of their fullest satisfaction with the same. Among the largest roofs covered with this material we may mention that of the Renfrew Manufacturing Co., of South Adams, Mass., where 58,000 square feet have been covered.

The material is also very well adapted for the lining of cisterns, being much cheaper than lead or zinc, and far better in a sanitary point of view. While metals oxidize and dissolve in smaller or larger quantities in the water contained in the cistern, according to the quality of the water, this material is absolutely insoluble, and unaffected by any kind of water. Recently a large water tank on the Albemarle Hotel in New York city, was lined with this material, and is of course perfectly tight, while the water is kept pure, rendering it adaptable for drinking purposes. We ought to add that the cost was only about one tenth of what would have been the cost of a lining of sheet-lead.

A DIAMOND HAWK.

THERE was shown in the International Exhibition of 1851 a celebrated figure of a Hawk composed entirely of gold and jewels—literally a mass of gems. The "Knyphausen Hawk" is life-size. It stands on a species of rockwork, and is decorated with numerous fine specimens of carbuncles, amethysts, turquoises, rubies, &c. When the head of the bird is removed a gold

drinking-cup is found to be concealed in the body, from which it is said two rival Dutch counts pledged each other at their reconciliation; and that this sumptuous Hawk was made to commemorate the event of the restoration of peace between the two families. The gold cup is an elegant piece of workmanship, and perhaps the counts, thinking with Moore, might have said—

> Send round the cup—for oh, there's a spell in
> Its every drop 'gainst the ills of mortality;
> Talk of the cordial that sparkled for Helen,
> Her cup was a fiction, but this is a reality.

It is the property of the Duke of Devonshire and valued at £40,000.

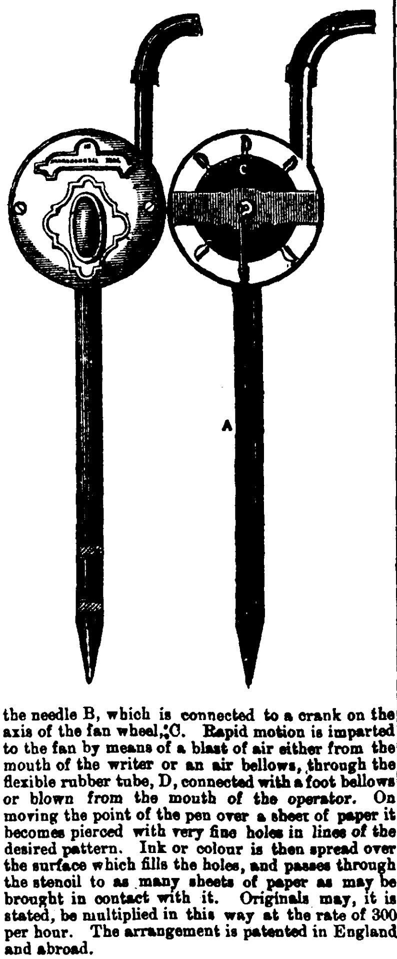
Abundance of Life in the Arctic Seas.

It is a popular error that the cold of the Arctic seas is unfavorable to fish life. "In truth," says Prof. Hind, "the Arctic seas and the great currents flowing from them are in many places a living mass, a vast ocean of living slime, and the all-pervading life which exists there affords the true solution of the problem which has so often presented itself to those engaged in the great fisheries—where the food comes from which gives sustenance to the countless millions of fish which swarm on the Labrador, on the coast of Newfoundland and in the Dominion and United States waters, or wherever the Arctic current exerts an active influence." In the Arctic seas the waters are characterized by a variety of colors; and it is found that if a fine insect net be towed after a ship it becomes covered with a film of green in green water and a film of brown in the brown water. These films are of organic origin. "It is a living slime, and where it abounds there are also to be found swarms of minute crustaceans, which feed on the slime, and in their turn become the food of larger animals." Dr. Brown has shown that the presence of this slime, spread over 100,000 square miles, provides food for myriads of birds that frequent the Arctic seas in summer, and also furnishes sustenance for the larger marine animals, up to the giant whale. "During the recent voyage of the *Valorous* to Disco, Dr. J. Gwyn Jeffreys, when between 200 and 300 miles east of Cape Farewell, caught with the towing net some floating masses of pulpy greenish matter, which was found to consist of a vast assemblage of diatoms, each individual being about the tenth of an inch in length. This diatom was subsequently found to have a very wide range, and to extend over some thousands of square miles." These contribute to the support of the smaller marine animals, and these in turn to higher forms.

This "slime of the ocean" appears to live abundantly in the coldest water and in the neighborhood of ice. The great ice drift coming from the Spitzbergen seas, sweeping round Cape Farewell, then northwesterly to Davis' straits, is augmented by immense bergs and floes from Baffin's bay and Hudson's straits, and at length, on the banks of Labrador, countless thousands of these ground, bringing with them their "slime." Thus the "slime" which accompanies the icebergs and ice floes of the Arctic current accumulates on the banks of northern Labrador, and renders the existence possible there of all those forms of marine life—from the diatom to the minute crustacean—and from the minute crustacean to the crab and prawn, together with molluscous animals and starfish, in vast profusion—which contribute to the support of the great schools of cod, which also find their home there.

PNEUMATIC PEN.

AMONG the many attempts of inventors to supply a ready means of copying an indefinite number of writings, drawings, &c., is the apparatus shown in sketch, which, apart from the question of utility, is at least simple and ingenious. The pneumatic pen, as it is called, is not new in principle, as a perforating machine, acting in a similar way, has been in use by embroidery manufacturers for many years, and all that the inventor of this apparatus has done is to arrange the whole thing in such a simple way that it can be as readily used as an ordinary pen. The tube, A, in the illustration contains

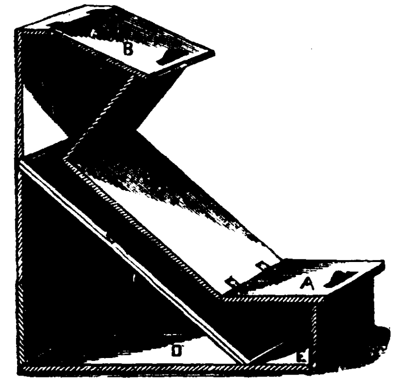


the needle B, which is connected to a crank on the axis of the fan wheel, C. Rapid motion is imparted to the fan by means of a blast of air either from the mouth of the writer or an air bellows, through the flexible rubber tube, D, connected with a foot bellows or blown from the mouth of the operator. On moving the point of the pen over a sheet of paper it becomes pierced with very fine holes in lines of the desired pattern. Ink or colour is then spread over the surface which fills the holes, and passes through the stencil to as many sheets of paper as may be brought in contact with it. Originals may, it is stated, be multiplied in this way at the rate of 300 per hour. The arrangement is patented in England and abroad.

To CLEAN TIN VESSELS.—First rub your tins with a damp cloth, then take dry flour and rub it on with your hands, and afterward take an old newspaper and rub the flour off, and the tins will shine as well as if half an hour had been spent in rubbing them with brick-dust or powder which soils the hands.

A Simple Ash-Sifter.

In no well managed family is a waste of coal allowed, but the ashes are separated from the cinders, and all of these that can be burned are utilized. Sifting coal ashes is generally a disagreeable job, and it is not to be wondered at that servants shirk it, when allowed to, yet by proper arrangements the labor can be greatly reduced, and the work done rapidly and neatly. We have on former occasions figured various ash-sifters, and we now give one devised by J. H. Ten Eyck, one of the firm of Ten Eyck & Co., of Auburn, N. Y., whose business of reproducing enlarged plain or colored portraits from photographs and daguerreotypes, brings them in relation with people all over the Union. The engraving, reproduced from an exceedingly neat drawing, shows the ash-sifter with one side removed, to expose the interior arrangement.



MR. TEN EYCK'S ASH SIFTER.

No measurements are given, because as Mr. T. E. suggests, it may be built in a wood-shed or other outbuilding, and will be of a size to suit the place, or the amount of work required of it. The sifter consists of an inclined sieve—the wire-cloth for which may be had of the desired fineness at the hardware stores—placed at such an angle, that the cinders will roll down of their own weight, while the ashes will fall through the meshes of the sieve. This sieve (*C*) is enclosed on all sides, and is provided with a receptacle (*B*) for the ashes, as they come from the grate, one (*D*) for the sifted ashes, and another (*E*) for the cinders freed from the ashes. Its working is automatic; the material to be sifted being put in at *B*, will slide down the sieve, until stopped by an accumulation of cinders at *E*, but on removing these, the sifting will go on again. The ashes must be removed, as they accumulate at *D*, or the sifter may be placed where the ashes will pass down through the floor, or out at one side of their own weight. Those who, like the writer, use the ashes in earth-closets, will prefer the construction shown in the engraving, in which they are kept dry and ready for use, when needed.

TEA AND HOT BISCUIT.—A professor of hygiene in a young ladies' seminary writes as follows: Popular opinion associates the teapot with the middle-aged and the elderly ladies, but popular opinion would find itself mistaken, if not shocked, to see the middle-aged lady teachers refreshing and rebuilding their brains, at the day's close, with that perfection of all foods and brain-builders, a glass of milk, while they of 16 sip their cups of tea. And then the fancy for hot biscuits is something truly marvelous. There was a time when nothing else could be had for breakfast. That, of course, was a glad time for the mistaken souls that dream of finding bliss in such a way, and was a no less glad time for the pill-vendors. Now, by one of those revolutions which come to families now and then, the hot biscuit breakfast has come to be a thing of the past, and substitute the "ounce of prevention" of dyspepsia—in the form of bread which has reached its perfection by means of the chemical change secured by an interval of 24 hours between the baking and the eating.

The Cheese Factory.

The tendency of modern improvements is to lighten labor and increase its effectiveness. By the introduction of various kinds of machinery, men engaged in agriculture are enabled to do in one day as much as could be done in a week without them. What the mower, reaper, and thrashing machine have done for farmers, the cheese factory has done for their wives and daughters. Years ago the work of the farmer's wife was never done. The first to go to work in the early morning, she was the last to rest, late in the evening, and after taking her share in the milking and the care of the milk, the churning and cheese-making, with all the slopping, and washing of pans, pails, cans, tubs, churns, and cheese-presses, were added as additional duty to the already sufficient cares of the household. The invention of the factory system changed all this, and relieved the women of the farm, not only from the care of the milk, but in a great measure from the milking as well. In the farmers' households there is now much more of comfort, leisure, and culture, than there was before all the labor-saving improvements were adopted, and where these are made the most of, there is more profit than formerly. There is more money passing through the dairy farmer's hands now than ever before, and the location of a cheese factory in a dairy district is to be considered as a decided benefit. The market for cheese is only opened as yet, and before it can be fully occupied, the number of cheese factories may be greatly multiplied. The home demand for this form of food has never been cultivated, the foreign market having received all the attention. There has been no desire to consult differing tastes, and but one kind of cheese, and good, bad, and indifferent of the kind, has been manufactured. An exacting purchaser of cheese might travel over a considerable portion of a large city, without finding any choice beyond an ill-flavored, leathery product which goes by this name, unless he found, by mere accident, some foreign cheese, or some of American make put up in the form of the foreign article, and intended to compete with it. It is a question whether the makers or the consumers are most to blame in this. But it is rarely that a good thing goes a begging for purchasers; on the contrary, a supply of it at once creates a remunerative demand, and which rapidly enlarges as the commodity becomes known. If we had a plenty of cheese of different qualities and shapes, calculated to please the palates and the eyes of purchasers, there is no doubt that our home market would soon increase so largely, that many new factories would be required to supply the demand, and that the prices obtained for the best product would be very profitable.

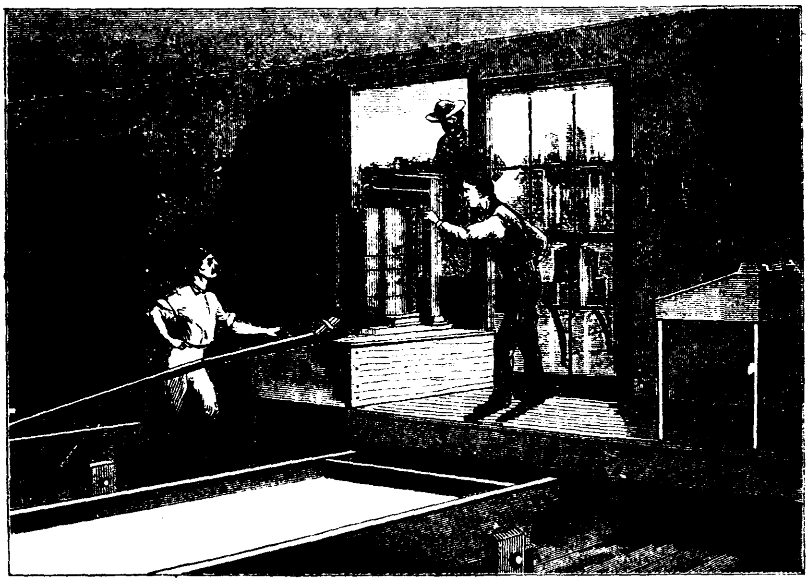


Fig. 1.—CHEESE FACTORY.—RECEIVING AND WEIGHING THE BUTTER.

The process of making factory cheese differs in no respect from that of the old dairy methods, excepting that much labor-saving machinery is used, and that the milk of 600 or 1,000 cows is made into cheese, with very little more cost for labor and utensils, than the milk of 20 or 30 cows would require in the old-fashioned home dairy. The product, if not equal to the best of the farm dairy cheese, is at least of even quality, and is better than the average of that formerly made in dairies. By the use of steam power, and an economical distribution of labor, the cost of making cheese is reduced to the lowest limit, and the return to the farmer for the milk, is greater than he could realize in any other way. An average of 2 cents per quart, or a gross sum of $40 to $50 for the season is the satisfactory and profitable income from each cow, when well managed; and this is paid in cash as the cheese may be marketed, without the loss of time that would be necessary in seeking a market. As the cheese factory is open but a portion of the season, this income therefore represents not much more than three-fourths of the product from each cow, and during the remainder of the time she adds to the amount of this income. As a rule, each dairy cow may be made, by the help of the factory, to yield the income stated in cash, besides furnishing some butter for family use or sale during the winter, when the factories are closed, if proper arrangements are made for this. With all their manifest advantages, it is strange that there are not more factories in districts where cows could easily be kept, as well as that dairymen should be contented with cows of so poor an average quality as are common. The experience of the past year, however, during which market gardening has been a losing business, has turned the attention of many farmers to the keeping of cows and the production of milk, and it is reasonable to expect that several factories will be erected in the neighborhood of the large cities where various articles of food, richly productive of milk, can be cheaply procured.

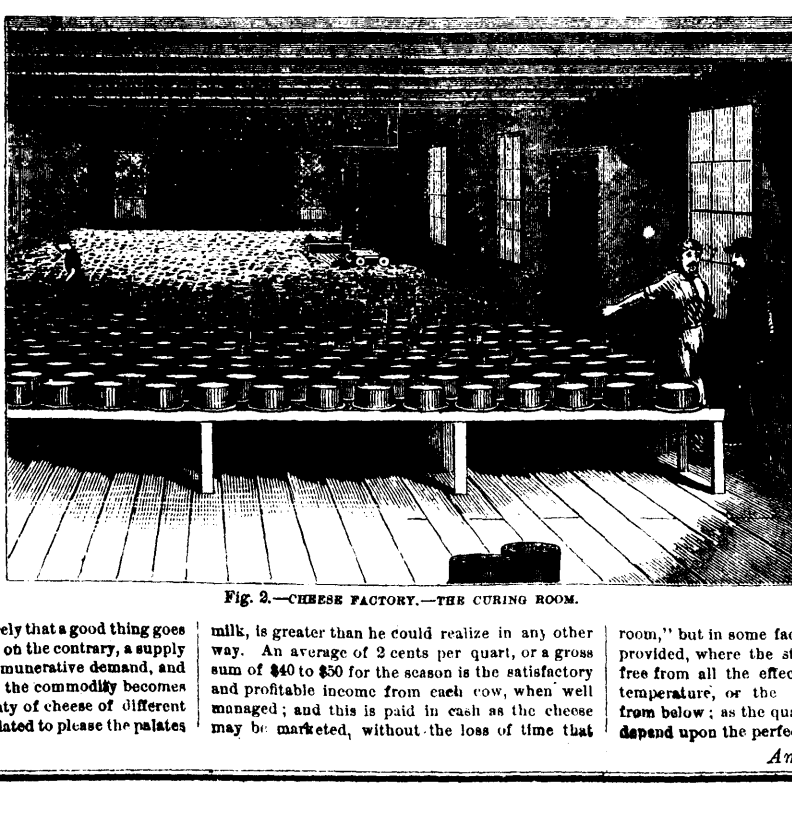


Fig. 2.—CHEESE FACTORY.—THE CURING ROOM.

The cheese factory routine is very simple, and is reduced to a very thorough system in which everything is conducted by strict rule. The milk brought to the factory by the patrons is weighed in a large receiving can, (see fig. 1), and is then run through a strainer and a tin spout into the vats, where it is brought by steam heat to the proper temperature for adding the rennet. The different processes through which the milk passes before it finally appears in the finished shape in the curing room, are referred to elsewhere. The last stage is by no means an unimportant one. The curing process needs to be managed with the greatest care. The curing house in which the cheese are kept to ripen, and await a purchaser, (shown in figure 2), is constructed so as to maintain an even temperature. The walls are double, and the space between them is filled with sawdust, or other non-conducting material. Steam pipes for heating the room in cool weather are fitted around the walls in many factories, and ample ventilation is provided for. The windows of the curing room are shaded with blinds, or what is preferable, should be made only upon the north side of the building. This room is generally situated above the "make-room," but in some factories a separate building is provided, where the stock of cheese can be kept free from all the effects of dampness, changes of temperature, or the partly vitiated atmosphere from below; as the quality and value of the cheese depend upon the perfectness of the curing.

American Agriculturist.

GLAZED FLOWER POTS FOR HOUSE PLANTS.—A writer in a contemporary magazine says that she has grown house-plants for twenty years in glazed pots, and found them to thrive better than plants do in the porous, unglazed pots. No doubt she is correct, if the atmosphere in which the plants are placed is as dry as that usually found in sitting rooms. The glazed surface will prevent the dry air from penetrating to the soil, much better than would the usual porous pot that we florists, who grow our plants in the greenhouses, find indispensable. There we have an atmosphere charged with moisture, which would soon be destructive to the plants, if grown in glazed pots, or such as were not porous. For the same reason, wooden boxes, or wooden flower pots, are better suited for plants grown in the dry atmosphere of an ordinary dwelling, than the pots usually used by florists. Of course, in any case, care must be used *never to water a plant until it is dry*, and then water freely. The "Adjustable Plant-box," described in the May number of the *American Agriculturist*, would seem to be just the thing required for nearly all kinds of plants


Fig. 3.—STIRRING THE CURD.


Fig. 4.—TAKING CURD FROM THE VATS.

of medium size. The wooden sides will resist the dry air of a sitting-room, just as effectually as the glazed, or painted, pottery ware will. and at the same time the means of drainage from over watering will be far better. We find (in correspondence with our customers) one great hindrance to growing flowers in rooms, particularly in the South and Southwestern States, is the difficulty in procuring suitable vessels to plant them in. This new flower-box, if it can be sold at a reasonable price, will be certain to have a large sale, for its lightness, compared with the clay pots of the same capacity, will enable it to be shipped at one-fourth the cost, and also with perfect safety from the breakage, which is another serious detriment in the transportation of the earthen-ware flower pot.

The Process of Cheese Making.

The establishment of the factory system in the cheese dairy, has made no change in the method of labor in the factory, however, is seen at once in glancing over the apparatus used. After the receiving and weighing of the milk, as shown in an illustration upon page 53, it is run into vats, which hold about 600 gallons each. In these the milk is warmed to about 80°, the proper temperature for coagulation; it is then well stirred to ensure the even distribution of heat, and the rennet is added and thoroughly mingled by stirring. The curdling is complete in 40 to 60 minutes, when the mass is stirred, or broken (fig. 3), by a many bladed curd knife into small blocks to facilitate its separation from the whey. When the curd has acquired sufficient firmness, it is more thoroughly broken, either by the hands or by what is known as an agitator. After the curd is broken up, heat is applied by means of steam pipes until the whey and curd together are brought to a temperature of about 100 degrees. During this heating the curd is stirred, and after the "cooking" is complete. it is left to rest, with occasional stirrings, until a proper degree of acidity, or rather approach to acidity, is observed in the whey. The whey is then drawn off, and the into a cooler, the vat being tipped by means of winches. This is shown at figure 4. The curd is left here to cool for a few minutes, when it is turned over and again left, to acquire a certain mellowness. It is then pressed for 10 minutes, when it is taken out, ground in the curd mill, (fig. 5,) and salted; two pounds of salt being used for 100 pounds of curd. The proper temperature of the curd is kept up during these processes by covering it with a cloth. After having been ground, and salted, the curd is put into the presses, (fig. 6,) in which it remains under pressure for two or three days. The pressure, which is regulated by means of a screw, should be sufficient to force out the whey, and consolidate the cheese. It is obvious that much tact and experience are needed to produce cheese of first quality, when it is considered what a multitude of interfering and complicated changes may occur in the condition of the curd, through atmospheric effects, the quality of the milk, or the rennet, or unavoidable difficulties in securing the precise degrees of heat or fermentation of the curd. But in the well managed cheese factory all danger of

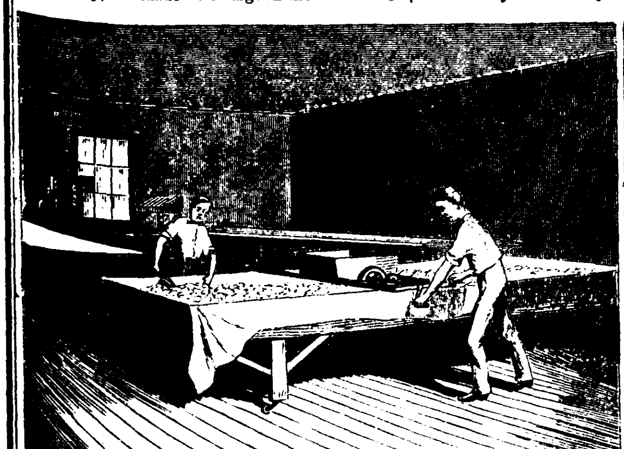


Fig. 5.—GRINDING THE CURD.

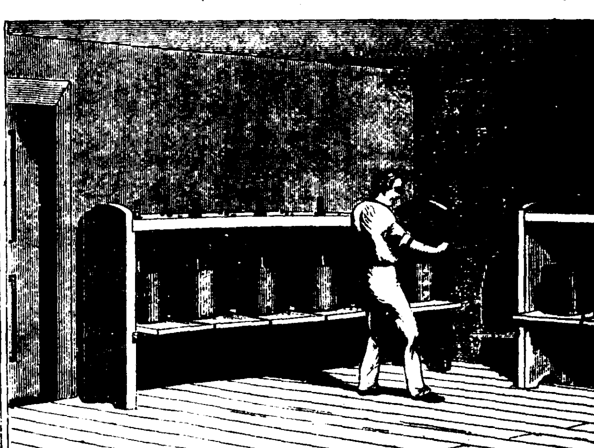


Fig. 6.—PRESSING THE CHEESE.

producing the curd from the milk, or the cheese from the curd. The improvements have been wholly in the machinery used in the processes; and in this respect the apparatus of the factories is constantly changing for the better. New contrivances for performing labor more easily, or for securing greater cleanliness or effectiveness in the methods curd is heaped in the vats and left to become sour. Upon the exact degree of acid that is developed in the curd, depends, in a great measure, the quality of the cheese; and the skillful practice of an experienced cheese maker is perhaps more needed just here than in any other part of the process. Those who need it can use what is known as the hot-iron failure is reduced to a minimum, as compared with the chances of a hundred small dairies all differently managed, and without the machinery needed for accurate manipulation. It is on account of this uniformity in quality that the American factory cheese fills a place in the markets of the world that no other dairy product has ever done, or is likely to do.

American Agriculturist.

PATTERN-MAKING.

By Joshua Rose.*

Of chisels the principal kinds used are the paring chisel, used entirely by hand pressure, and the firmer chisel, for use with the mallet. The difference between the two is that the paring chisel is the longer. A paring chisel, worn to half its original length, will, however, answer for use as a firmer chisel, because, when so worn, it is sufficiently long for the duty. A chisel should not, however, be used indiscriminately as a paring and firmer chisel, for the reason that the paring chisel requires to be kept in much better order than the firmer chisel does. It is necessary to have several sizes of chisels, varying in width from an eighth of an inch to an inch and a half. A paring chisel for general use is shown in Fig 18. Its width is about one and a half inches, and its handle should be exactly of the form shown in the engraving, the total length of handle being six inches, from A to B being one and a half inches, and the diameter at C, and from B upwards, being one and a half inches.† The hollow below B is of three-eighths inches radius, and the diameter at D is one inch. This shape and size gives a good purchase, especially from A to B, where the hand is most often applied, the end, E, being against the operator's shoulder. A firmer chisel having a handle of the ordinary pattern is shown in Fig. 19.

Chisels are sharpened in the same manner as plane irons; but being usually narrower, they require special attention in the grinding, as they should be held against the grindstone with an amount of pressure proportionate to their width. In describing Figs. 5 and 6, in a previous issue, we explained how a long feather edge may be given to a tool in the grinding; and these remarks apply especially to chisels. Hence, towards the finishing part of the grinding operation, the chisel should be held very lightly against the stone; the flat face of the chisel should never be ground, but should be kept straight and even, otherwise the whole value of the tool will be impaired. In setting the edge of a chisel upon an oilstone, it is necessary to exercise great care that the hands are not elevated so as to oilstone the blade at a different bevel to that at which it was ground, and not to allow the movement of the hands to be such as to round off the bevel face at and near the cutting edge, an error which, from lack of experience, is very apt to occur. The position in which the bevel of the chisel should be pressed to the oilstone should be such that the marks made by the oilstone will lie from the back of the bevel to the cutting edge, but be shown more strongly at and towards the cutting edge. The motion of the hands of the operator should not be simply back and forth, parallel with the length of the oilstone, but partly diagonal which will greatly assist in keeping the bevel level with the oilstone. Very little pressure should be applied to the chisel during the latter part of the process of oilstoning; and the flat face of the chisel should be held level with the face of the oilstone, and moved diagonally under a light pressure, sufficient only to remove the wire edge. After the setting is complete, the chisel should be lapped upon the hand to remove the fine wire edge left by the oilstone.

The next tool is the gouge, of which there are several kinds. Those having the bevel on the concave side are termed inside gouges; and when the bevel is on the convex side, they are called outside gouges. Gouges, like chisels, are also classed into firmer and paring gouges, the distinction between the two being the same as in the case of chisels. It is not necessary to possess a full set of each kind of gouges; half a set each of inside and outside will suffice, with an extra one or two for paring purposes. Fig. 20 represents a paring, and Fig. 21 a firmer outside gouge.

The inside gouge may be ground a little keener than the chisel or plane iron, and requires care in the operation, since it has generally to be ground on the corner of the grindstone, which is rarely of the same curve as the gouge requires. In oilstoning a gouge, what is called a slip is employed. Slips are wedge-shaped pieces of oilstone, of various curves and shapes to suit the purposes for which they are applied. The gouge should be held in the left hand and the slip in the right, the latter being supplied with clean oil. The back or convex side of the gouge must be laid level on the face of the oilstone, and the handle worked to and from the workman, who must roll it at the same time, so as to bring every part of the curve of the gouge in contact with the face of the oilstone. All the remarks upon grinding and oilstoning chisels apply with greater force to gouges, because the small amount of the surface of the gouge, in contact with either the grindstone or oilstone, renders it extremely liable to the formation of a feather edge in grinding, and a wire edge in oilstoning. In grinding outside gouges, a new feature steps in; for if the gouge be kept at the same inclination throughout the grinding, as in the case of all the tools heretofore mentioned, the centre of the gouge will be keener than the corners, to avoid which the gouge is given a rolling motion to bring every part against the action of the grindstone, while at the same time lowering the back hand as the corners of the gouge approach the stone. This, if evenly performed, gives an equal keenness to all parts of the cutting edge. The same rising and falling motion of the back hand is necessary in oilstoning the convex side of the gouge. The concave side is to be rubbed with an oilstone slip, taking care to let the slip be flat in the trough of the gouge and not elevated at the near end; for if once a habit of bevelling, however slightly, the flat faces of tools is contracted, it tends to increase, so that the tools finally lose their characteristics, and are in fact ruined so far as their application to good work is concerned. Hollow gouges are dispensed with by the use of rabbet planes, shown in Figs. 11, 12, 13, p. 376.

FIG. 18

FIG. 19

FIG. 20

FIG. 21

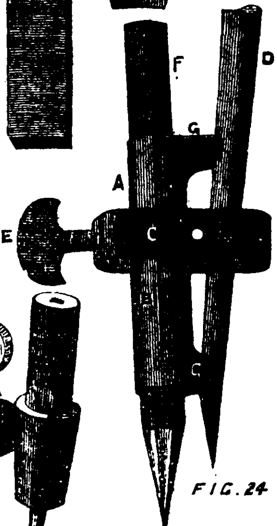


FIG. 24

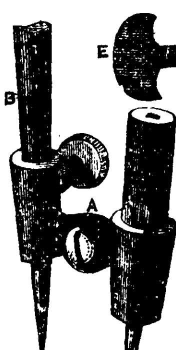


FIG. 27

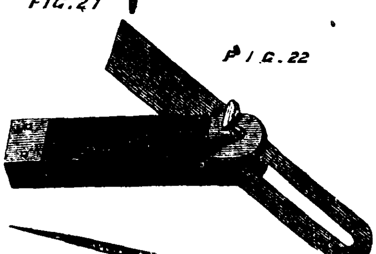


FIG. 22

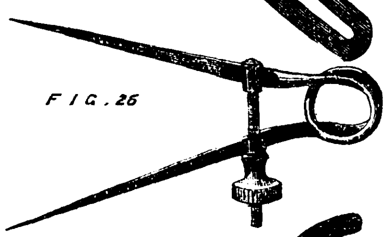
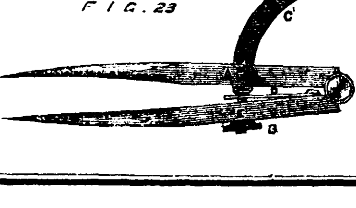


FIG. 26

FIG. 23



Several sizes of squares are necessary to the pattern-maker, because his work necessitates in many cases that the blade be short in order to admit of its application to the work. For an ordinary try square, the blade should be of sawblade, and the back of hard wood, the inside and outside edges of the back being covered with sheet metal to prevent undue wear. In addition to this, however, a bevel square is required; and it is best to have one with a sliding blade, so that the length it projects from the square back, on either side, may be adjusted to suit the work. Such a bevel square is illustrated in Fig. 22.

Of compasses there are two kinds, one being plain and having no means of permanent adjustment. This is used for casual measurements or marking. The other has an attachment by which it may be permanently set, as shown in Fig. 23, in which A represents a thumb screw employed to set one leg firmly against the radius piece, C, and B being an adjusting screw for finally adjusting the compass points after the thumbscrew, A, is fastened, the spring, D, operating to keep the leg, E, firmly against the face of the screw, B; so that, when the adjustment of the compass points is once properly made, the compasses may be laid upon the bench and used from time to time without danger of the adjustment being altered by handling or by a slight blow.

An excellent attachment for compass points has lately come into use; it is for the purpose of fastening to the marking leg a pencil, to avoid scratching the surface of the work with the compass point. This device and its mode of application are shown in Fig. 24, in which A represents a thin tube with feet on it, provided with the split, B. C is a clamp provided with a thumbscrew, E. D represents one of the compass legs. F is a piece of lead pencil which passes through the tube, A. The attachment is slipped on the compass leg, and the screw is tightened up, clamping that leg to the feet, G G, and clamping at the same time the pencil in the tube. Another of these attachments, in which the pencil point is adjustable in a direction other than that in which the compass point stands, is shown in Fig. 25, the pencil tube being swivelled at A, and B representing the compass leg.

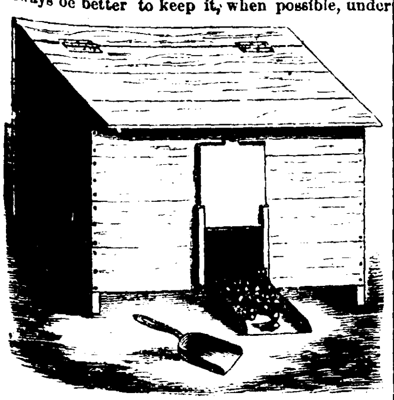
The points of compasses should be forged out when they get thick from wearing short, and they should be tempered to a blue colour. For marking small holes, compasses are too cumbersome for fine work, and spring dividers are preferable. A recent improvement in these tools consist in making the spring helical, as shown in Fig. 26, instead of making it abroad, flat, and thin, as formerly.

Actual Cautery in Diseases of Bones.—M. Philippeaux has published an article in the *Lyon Médical* of Aug. 6th, 1876, in which he shows that caries of the os calcis may be arrested by perforating the bone with a red hot skewer, endeavouring thus to destroy the carious portion of the bone and setting up healthy action! The preceeding is especially applicable to young people.

To Blacken Brass, Silver, &c.—The best means for producing a black surface on brass, pinchbeck, or silver, is said to be platinum chloride, which is allowed to liquefy by exposure to the air. It is rubbed in with the finger, or best, with the ball of the thumb. After blacking, the object is washed and polished with oil and leather. Platinum chloride is dear, but a little of it will do a great deal of work.

Bin for Coal.

An unfortunately too common manner of keeping fuel, whether coal or wood, by those who live in the country, is to have it in a pile out of doors, and unsheltered. In snowy weather the fuel is dug out from beneath a snow-drift, and in rainy weather it is brought in saturated with water, in either case making it very disagreeable and untidy in a well ordered kitchen. Indeed, to see a pile of fuel in this condition in the back yard, rather forcibly indicates that there is an untidy kitchen within doors. Fuel should always be under cover. Coal may be very well kept in a neat bin, which will still be neat, although made of rough materials. A packing-box of sufficient size, cut sloping at the top, and furnished with a lid, will make an excellent coal-bin; or it may be made of rough or dressed boards, and painted. It should be raised a few inches from the ground, by being placed upon stout posts, or a few bricks, and the top should be of such a hight that coal may be shoveled directly into it from a wagon-box. A sliding-door should be made in the front, with a small, sloping platform, from which to shovel up the coal which escapes when the door is lifted. The door should be kept closed when not in use, in order that coal may not be scattered about. If shed-room is scarce, the bin may be kept near the back door, but it would always be better to keep it, when possible, under



CONVENIENT COAL-BIN.

cover. The engraving shows the shape and proportions of a very convenient coal-bin. If wood or coal can not be reached without going out of doors, then the kitchen should be provided with a coal or wood box, as the case may be, and it should be made the especial business of some one, to see every morning that it contains a full day's supply.

Butter-Workers.

The hard work of the dairy is being rapidly transferred from the homestead to the factory, or is becoming greatly lightened by the use of improved machinery. Animal-power in the smaller dairies, and steam in the factories, perform the heavy labor of churning, and the working of the butter is now rendered easy by a great variety of contrivances, which get rid of the buttermilk, and mix the butter as well, at least, as it could be done by hand, and with a great saving of labor. Upon the proper working of the butter, depends to a very great extent its quality, flavor, and its ability to keep sweet for a long period, and the better this is done, the better will be the butter. Much butter is spoiled by bad working, and for the best methods of working, a peculiar manipulation or "sleight of hand" is needed. The butter must be gashed, and squeezed, so as to provide an outlet for the buttermilk, and to force it out of the mass. But this must be accomplished without any drawing or plastering motion, by which the granular, or waxy, texture of the butter would be destroyed, and a greasy character given to it. The chopping action of the butter-ladle in the hands of the dairywoman, and the careful squeezing of the butter thus gashed into slices—both very laborious when done by hand—are now performed in the most perfect manner by several machines. One of these machines of

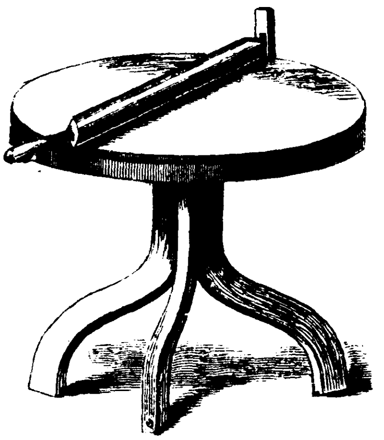


Fig. 2.—CALIFORNIA BUTTER-WORKER.

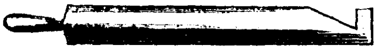


Fig. 3.—BUTTER-KNIFE.

more than ordinary usefulness, is shown in figure 1. It consists of a tray, and a traveling roller, which is furnished with several wings or radiating blades. The roller is mounted in a frame, which, as the handle is turned, works back and forth upon a metal rack, and carries the roller over the butter in the tray. The butter is cut and gashed by the wings or blades of the roller, and the buttermilk is squeezed out at the same time. If desired, water may be used to wash the butter. This machine is extensively used in Chester Co., Penn., and has been tested by some dairymen of our acquaintance, with satisfaction. It is known as the Reed butter-worker. A worker that is used in a large dairy in California, is shown in figure 2. This particular dairy is known as the Point Reyes' Ranche, and consists of a tract of over 45,000 acres of land, which juts out into the Pacific Ocean, being joined to the mainland by a narrow neck only. There are 3,000 cows upon this point, kept for butter-making. The tract is divided into seventeen farms, which, with the cows, are leased to tenants at a stated rent. One of these tenants has 300 cows. The dairies upon these farms are furnished by their owner with all the modern improvements. Among these is this butter-worker. This is a stout table of hard wood, standing upon three legs, which are screwed firmly to the floor. In the center of the table there is a socket. A revolving top is placed upon this table, and is kept in its position by means of a pivot in the center, which fits into the socket. At one side of the table there is a standard, which rises above the revolving plate. Into this standard fits the end of a sort of wooden knife, shown at figure 3, which has an oval or double-bladed form. The butter being placed upon the revolving portion of the table, is cut and squeezed with the lever until it is sufficiently worked, when it is salted and left for a time.

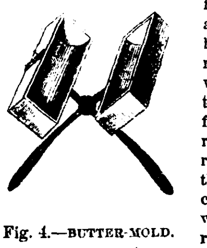


Fig. 4.—BUTTER-MOLD.

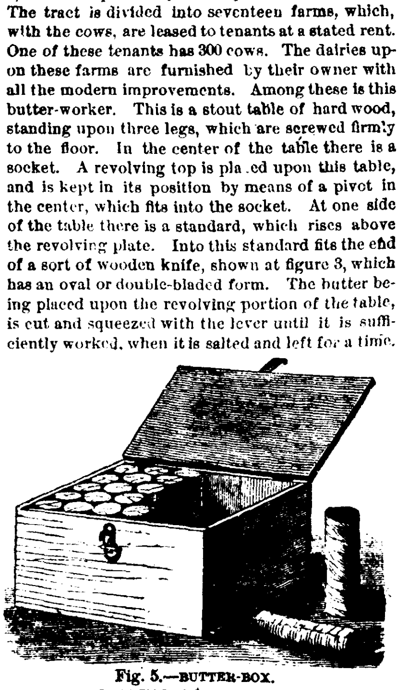


Fig. 5.—BUTTER-BOX.

After this, it is again worked, and pressed into molds, (fig. 4), or into cylindrical rolls, which are wrapped in muslin, and packed in a square box upon their ends, (figure 5) The molds are made of *lignum vitæ*, in the manner of a pair of bullet-molds. Each half being filled with the finished butter, the handles are forcibly squeezed together, and the butter is compressed firmly into a solid roll, which drops from the mold when it is opened. The mold is kept wetted with cold water during the operation. When the box is packed full, the lid, which fits close upon the ends of the rolls, is shut down and locked, and the butter is ready for market. Figure 6 represents a small knife of *lignum vitæ*, which is used to run around the inside of the milk pans, to separate the cream for skimming.

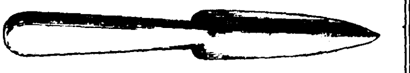
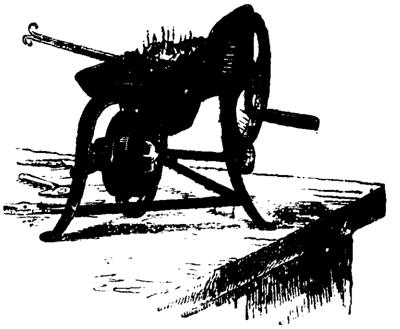


Fig. 6.—CREAM SEPARATOR.

The use of this simple little tool is to be recommended in every dairy, even if but one cow is kept, so that the uncleanly method of separating the cream with the forefinger, may be avoided. Such a knife can be easily whittled out from a piece of maple, birch, or ironwood, with a jack-knife, and should be kept clean and hung up in the dairy.

Portable Forges.

A portable forge, suitable for the farm workshop, is here illustrated. This has the merit of cheap-



PORTABLE FORGE.

ness in cost, and of occupying but little space. It may be placed upon a box or a work-bench, and used with the greatest convenience. It stands upon legs only 13 inches high, and weighs but 50 lbs. The blast is worked by gearing, and is sufficiently strong to get up a heat that will melt inch iron in two minutes, or get a welding heat upon a 2½-inch bar in ten minutes. The bearings are made of bronze, and those of the fan are self-lubricating. The cost is only $16, and there are few machines so useful to the farmer, mechanic, or amateur, that costs so small a sum. In a communication from a farmer, referring to this forge, the writer says that he saved $10 in one day, last harvest, by having a small forge on his farm, which enabled him to repair a break in his mower, without loss of time. These forges are made by the Empire Forge Company, of Troy, N. Y., whose larger machines have been already described in the *American Agriculturist*.

The Sycamore of Palestine.—The sycamore of Scripture, it may be observed, is a species of fig. The English sycamore, a maple, and our sycamore, the buttonwood, being so called from the resemblance of their leaves to the old-time fig. It was at one time thought, from carvings, that the orange grew in Egypt; but the representations are now proved to be the fruit of this sycamore fig.

Cast-iron Glazed Tiles.—The *Deutsche Allgem. Zeitz*, says: At the iron works of Groeditz, near Riesa, Germany, glazed cast-iron tiles for roofing are now made. They are not heavier than ordinary tiles and are very strong. The railroad depots of Loebau and of Reichenbach, and of many private houses of Hamburg and Dresden are roofed with them.

Hints for Iron Melters.

The man who prepares and charges the cupola in a foundry holds the key to the production of good castings, no matter how successfully the molder may do his work. It is important, then, that all melters should study their business and learn what are the points of success. In the course of an able series of articles on iron-founding, which Edward Kirk is writing for the *Iron Age*, we find the following hints on the work of the melter: The practical and scientific melter is the melter who understands his business and attends to his business; he chips out his cupola, and daubs it up in proper shape; he puts up the iron bottom and sees that it fits close and solid and is properly supported; he puts in the sand-bottom, and sees that it is packed solid and even, and has the proper pitch, without any hills or hollows in it; he puts in the front so that it never blows out, and he sees that the spout is in proper shape; he always has the tapping bars drawn down to a sharp point, so that he can tap with ease, and have the tap-hole large or small; he has his bod clay thoroughly mixed, and his bod-sticks always handy and in good shape. When he wants to stop-up he takes the bod-stick and sees that there is a bod on it in proper shape; he then puts the bod right over the tap-hole and gives it a sudden downward pressure, and stops the iron with ease. He puts in the shavings to light the fire with, and sees that they are properly spread over the sand-bottom, so as to light the wood evenly—the wood is cut short and split, and every piece is laid in the cupola in proper shape, so as to give the fire the best possible chance to burn and light the coke or coal evenly; he selects a few small pieces of coal or coke that will light easily, and puts them in on the wood; he then puts in the bed. If the cupola has a good draft he puts in all of the bed before the fire is lit, if the cupola has a poor draft, he only puts in part of the bed before the fire is lit, and the balance after the fire has got thoroughly started. He sees that the bed is evenly burnt and level on top before the iron is charged; he charges the iron compactly together, so that it will get the good of all the heat from the fuel; he sees that every charge of iron is level and even on top when all in; he sees that every charge of fuel is properly distributed over the iron, so that it will melt the next charge of iron properly, and at an even temperature; he increases or diminishes the amount of coal or coke in the bed, or between the charges of iron, at the rate of 25 or 50 pounds at a time, until he finds the exact amount required; he increases or diminishes the amount of iron on the bed, or in the charges, at the rate of 100 pounds at a time, until he finds the exact amount of iron that can be melted in that particular cupola with the smallest percentage of fuel; he then continues that charging without any variation; if he gets in a poor lot of fuel, he may increase the bed and charges of fuel a few pounds; or, if the fuel is extra good, he may decrease a few pounds, but always with caution and safety; he watches the direction the wind blows, and notes the effect that a north, south, east or west wind has upon the draft of his cupola, and he lights his fire accordingly, so as to have the bed burnt as near alike every day as possible; he inspects the blast-pipe and tuyeres every day to see that there are no holes in the pipe through which the blast may escape, and to see that the tuyeres are in proper shape, so that the blast will not escape up behind and through the lining, in place of through the stock; he notices the exact effect of the blast upon the cupola, and he knows when he is not getting enough blast, and at once complains to the foreman or engineer; he looks around the shop, toward the last of the heat, and sees or asks the foreman how much more iron is wanted; he then looks into the cupola, and if he thinks there is not enough iron in to pour off with, he throws in a little more before the stock gets too low to melt it. The practical and scientific melter does everything according to rule, and not by guess, and the foundrymen can depend upon him having good, hot, clean iron every day, if it is possible to make it in his cupola.

TIPLING NURSES.—There can be no doubt that nurses' bottles may be worse for children than nursing-bottles. M. Anarien, in the *Archives de Tocologie*, reports two cases in which children, at the breast of apparently healthy and well-to-do nurses, were suffering from convulsions, and in which the children wese saved by depriving the nurses of alcoholic potations, in which they were found to be freely indulging. As the Philadelphia *Reporter* remarks, it is a pernicious delusion of nursing mothers and wet-nurses, that, when suckling infants, they required to be "kept up" by alcoholic liquors; and women who are little given to alcohol at other times become, for the nonce, determined tipplers,—this being, perhaps, of all other times that when alcohol is likely to do most harm and least good.

EGG OIL FOR WOUNDS.—Extraordinary stories, says the *Druggists' Circular*, are told of the healing properties of a new oil, which is easily made from the yolk of hens' eggs. The eggs are first boiled hard, and the yolks are then removed, crushed and placed over a fire, where they are carefully stirred until the substance is just on the point of catching fire, when the oil separates and may be poured off. One yolk will yield nearly two teaspoonfuls of oil. It is in general use among the colonists of south Russia as a means of curing cuts and bruises, etc.

A GOOD RESOLUTION.—A physician who has passed his three-score years and ten writes as follows: Well do I remember the day and the hour when I made, to me, the great discovery that I could conquer the "blues." I had suffered for a month the most intense mental pain because my business did not go to suit me. I found fault with my wife and children, and nothing suited me. Things were getting most uncomfortable for all of us. I got up one morning as usual and expected to have a bad day, when all at once the impulse seized me as if it had come from the other world, and, straightening myself up to my full might, I said to myself emphatically, "By the Eternal, these miserable feelings have got to go; not once to-day will I tolerate one of them in my mind for an instant." I kept my word, and have done so till now, and find it easy enough to keep the "blues" at bay.

STEEL INSTEAD OF BRONZE.—The officers of the royal gun factories, says *Iron*, have been informed that the French government has resolved to discard its present system of bronze field-guns and make its guns of steel rings, puddled and cast. It has been under the consideration of the French artillerists to adopt the English system of built-up, wrought-iron coils, including the muzzle-loading principle; but this would have required a new and extensive plant of machinery, whereas the transition from bronze to steel can be effected with very little trouble and expense, the substitution of a different metal being almost the only change. The preference of the French for breech-loading cannon is to be gratified by the application to these guns of the "screw relieve," or French system, and two kinds of field-pieces are to be produced—one rather larger than the English 16-pounder and the other somewhat smaller than the English nine-pounder, corresponding in size more nearly to the German than the English artillery.

Notes on Concrete.

Concrete in this State is widely used for foundations and for other building purposes. The following hints from *Saward's Journal* will be found valuable: Much harm is done, time wasted and annoyance caused by the habit of inexperienced persons picking and poking at cement samples of work, before it has had time to get strength. To such persons quick-setting, light-weight cements would appear to promise good results; but it is now well known by every one practically acquainted with the use of cement, that the well-burned, heavy, finely-ground, slow-setting concretes are the best for concrete purposes.

The water for mixing concrete should be clean. It is possible to destroy much of the strength of cement by using dirty or polluted water. Sea water has not been found injurious, but it is supposed to delay the setting. Respecting the quantity of water to be used there is more danger to be apprehended from using less than from using more than the right quantity. The correct quantity of water is of course sufficient to convert the cement into a thin paste, that shall completely coat and cause to adhere all the particles of the aggregate.

Concrete mixed by hand is preferable, as it is important to have the materials all mixed dry before mixing with water. Crystallization, or setting, begins at once with the addition of the water, and as little time as possible should be spent in thoroughly mixing and placing into the mold, or apparatus, after water has been added. There are many various concrete mixing machines, most of them being unnecessarily complicated; the best being a plain revolving cylinder working horizontally. Concrete mixed in machines is generally over-mixed after the addition of water.

The only liability to defects in cementing on concrete walls or floors, is where two coats are used, and when idle and ignorant workmen, to save themselves trouble, use too large a proportion of cement for the thin finishing coat; then in consequence of the variation in the contraction of the two coats, the outer one is liable to show fine surface or (as they are often called) sun cracks, and even in some cases to peel off. Of course this liability being known, can easily be provided against.

CLIMATIC CHANGES.—It would seem that not only is the climate of Iceland growing so cold that grain cannot ripen there, but that of Scandinavia and western Europe is becoming more severe. This is due, it is supposed, to the steady descent of the ice of the far north upon the shores of Iceland. It has been ascertained that the temperature of Greenland was once much more mild than at present. Plants have been discovered in a fossil state there which cannot now show a sign of life. In the Atlantic, also, ice has been found much further south than formerly. Is another ice age slowly making its approach?

TAKE CARE OF YOURSELF.—*Hall's Journal of Health* gives the following good advice: A New York drayman or hack driver, considers his horse a part and parcel of himself, and the moment his animal ceases motion in cold weather, that moment he covers him with a blanket. Why this care? He knows that if neglected, the horse will take cold, and that in a day or two, he will most probably die of some form of inflammation about the lungs; yet multitudes of people perish every year, from being cooled off too quick after exercising. More people die prematurely from want of care in any given year, than perish by plague, famine, pestilence and war. The Duke of Wellington died of an over-hearty meal of venison in November. Gen. Taylor was taken from the White House to the grave, by a bowl of fruite and iced milk, on a Fourth of July. It is a good omen, that intelligent, reflecting and humane teachers in different parts of the country, are beginning to make personal health one of the branches of an elementary education. Is it not wonderful that more efficient steps have not been taken in that direction long ago.

THE BEST PROTECTION FOR TEETH.—Nothing better than brushing night and morning with tincture of myrrh, using a soft brush. The following is the best tooth powder ever devised:—Take 1 oz. of finely-powdered cuttle fish-bone, 1 oz. of powdered orris root, ½ oz. of powdered myrrh, ½ oz. of cassia, 1 drachm of bol. armeniæ, all powdered. Pass all these ingredients, after mixing them well, through a moderately fine sieve, and use two or three times a week.

OUR IGNORANCE.—S. D. Goss, M. D., says: "Of the essence of disease nothing is known."

THE BEAVER (*Castor Fiber.*)

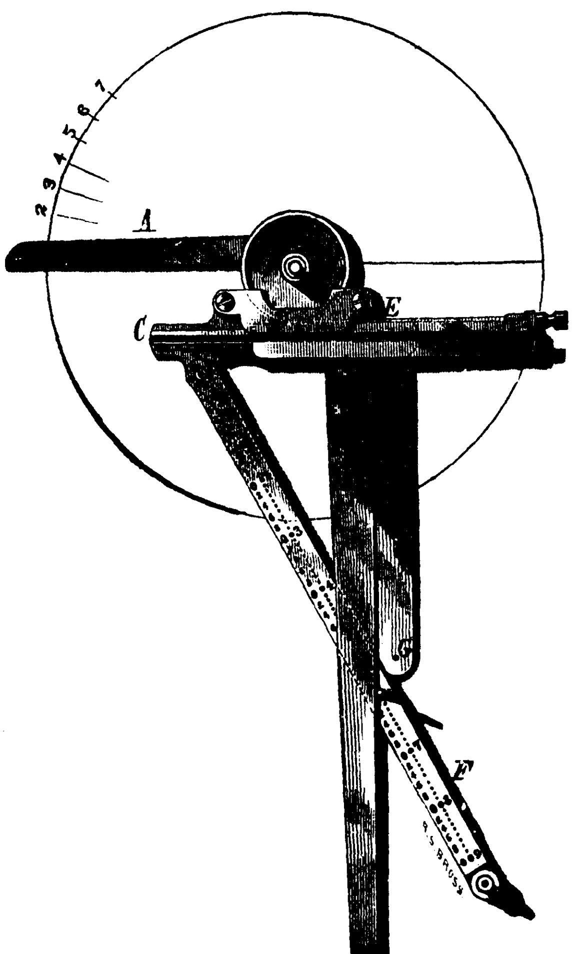
(BY G. J. SUTCLIFFE.)

This well-known animal belongs to the *rodentia* or gnawing animals, so called from the structure of their teeth, which are admirably adapted for gnawing purposes. The constant wear of the teeth would soon kill the animal if they were not provided with some special provision; in the rodents may be seen a great proof of the wisdom and wonderful power of our Great Maker. Their teeth are so peculiarly fitted and shaped, that as fast as they wear away, they are renewed, and thus a rodent of six years has its teeth as sharp and as white as one of six months. The common beaver is celebrated in all countries, not only for its wonderful engineering power, but for its valuable fur. The home of this animal is in North America; here they live in societies, and build their mechanical dams in the rivers and creeks. Their dams are made to stop the water running and raise it to the level required for the building of their houses. These dams are composed of logs, mud, and stones, and are twelve feet thick at the bottom, but narrow as they reach the surface of the water; if the stream is a rapid one, the dams curve off, and thus offer a greater resistance to the water. The logs are laid horizontally and kept down with mud and stones. The homes or "lodges" of the beaver are composed of branches of trees, mud, and moss, the roof is covered with a thick layer of mud, which is renewed whenever required. Each "lodge" contains from three to six beavers. Around the lodges the beavers excavate a ditch; in this they store the logs for winter use. These logs supply both food and building material, for the beaver eats the bark, and adds the stripped trunk to the dam or "lodge." The female beaver produces four or five young at a birth. The length of this animal is three and a half feet, the tail is flat, and covered with scales; it is of great use in swimming, and smoothing down the mud, roots, &c. The flesh of the beaver is eaten by the trappers; it is very rich and oily. The beaver supplies the world with another article of commerce, namely its perfume; this is secreted in glands near the tail, and is called "back stone" by the trappers. The beavers are always attracted to each other by this scent; when a beaver feels the superabundance of the perfume becoming troublesome, it casts it out on to the ground; this is smelt by another beaver who hastens to the spot, covers the old "back stone" over with leaves, and casts out its own superabundant perfume. Knowing this peculiarity of the beaver, the trappers bait their traps with a stick dipped in the "back stone;" this is smelt by the beavers who rush to it, and get imprisoned in the trap. Old beavers are very cunning and are very difficult to catch; if they see a trap, they creep underneath the bank, spring the trap, and cover it over with mud and leaves; young beavers, however, are not so wary, and fall victims to their curiosity. When pure the perfume is very strong, but when diluted becomes a pleasant scent. The teeth of the beaver are very powerful and it can gnaw through a log eighteen inches in diameter. Considering that hundreds of logs are required for one dam, the quantity of wood gnawed by a single beaver must be something enormous. The beaver is found in America and the northern part of Europe, and was once an inhabitant of Great Britain.

STOLP'S COMPLETE GEAR INSTRUMENT.

Of the various contrivances used to transmit and modify power, toothed gearing stands second, if, indeed, it cannot justly claim the first position in the order of importance. Ready means for its correct construction should therefore be in the hands of all designers. But the great abundance of rattling machines, put in places where we ought to find truthful gearing, indicates that sufficiently simply and easy means for correct delineation are not at the hand of the majority of designers. The instrument illustrated herewith is claimed to so far remedy this evil as to leave no longer any excuse for noisy gearing. It divides the circle, or any part of it, into any desired number of equal parts or pitch spaces; finds the radius of a circle of given pitch; gives the length and thickness of tooth according to any given rule; forms a substitute for the Willis odontograph, giving the centers for the tooth curves; or gives the lines to be used for placing in position the new templet odontograph.

A is an arm or straight edge attached radially to a central wheel, B, so as to swing with it, to any position on the arc



STOLP'S COMPLETE GEAR INSTRUMENT.

to be divided. B is mounted upon a hollow taper stud, which projects up from an extension from the main frame or bed piece, C. A centering pin is passed through the hollow stud into the drawing board, to center the instrument, and a second pin is attached in the end of the arm, G, to be pressed down to fasten the instrument in position. A T square, E, fits to slide nicely in dovetailed groove in bed piece, C. A clip, D, holds the T square properly in the groove. A steel wire attached at one end of the head of the T square, passes around the wheel, B, and is there fastened to it. A second wire is secured to the opposite end of E, passing in the opposite direction around B, and there made fast. A thumb screw takes up the slack. Now when B and A revolve around the center stud, the T square is made to slide in its groove by the wires winding and unwinding from B. It is evident that, when A thus swings through equal angular spaces, the long arm of the T square will be displaced laterally by equal spaces.

Now if any scale of equal parts be placed under the arm of E, to be used as a guide in turning A, it is plain that equal spaces or angles will be laid off on any circle concentric with B, also if the scale be inclined more or less, say like the bar, F, these inclinations will result in different angles at A. Hence if, for instance, any scale be set at such an angle under E that 50 divisions are passed over by E while A moves through 180°, the semicircle will, of course, be divided into 50 parts; in like manner any arc may be divided into any number of parts, also any angle can be laid out.

But ordinary scales will require careful sighting. Each instrument is accompanied with one or more scales formed by drilling holes in a bar, F, into which a pin is set at the desired places, thus forming a stop for E; one end of F is jointed to C, and the other is secured to the drawing by an adjusting pin.

The Mineral Wealth of Turkey.—The Grand Vizier is doing his best to create new resources, but he is nearly at his wit's ends. As a last expedient, he proposes to lease the working of the coal mine at Heraclea, on the Black Sea, in security for a new loan he is trying to negotiate. This mine produces a good coal, and, as it lies near the sea, there is but little difficulty in the transport of the coal. The Turks have never been successful in mining operations. They have but few men of practical science, and then there is so much rascality among their officers that there is but little net revenue from such undertakings. They are too jealous of foreigners to concede their mines to them. The empire abounds in mineral wealth of all kinds, particularly Thessaly, Bosnia and Asia Minor. On the slopes of Olympus, in the vale of Tempe, an English company has for many years been engaged in mining operations, chiefly among the silver and gold deposits imbedded in the fanes of this rendezvous of the gods of Grecian fable. This is the only foreign company of any note that has been able to obtain a valuable concession in the mineral districts. Bosnia abounds in copper, lead, zinc, silver and iron of the first quality. Should it fall into the hands of Austria, as it is likely to do in the settlement of the Eastern question, it will prove a source of great wealth to that government. It is the opinion of a celebrated Russian scientific writer, who explored Asia Minor in detail some ten years ago, and who published the results of his survey, that the sands of the Pactolus, if properly worked, would afford from the accumulated deposits it has piled upon its shores a rich yield in gold, if not as great as it did to Crœsus, yet in quantities that would astonish the world. At various epochs the Pactolus has revived its fame as a gold-bearing stream. The grains of this precious ore found in its bed and on its shores are, no doubt, triturated from the quartz rocks in Mt. Tmolus, where lie its foundations. In the time of the Lydian kings the gold treasure of the Pactolus made Sardis the richest city of the Eastern world. Shafts sunk in the bowels of the mountain and crushing mills after the California pattern might render the Pactolus and its mountain region as famous as in ancient times. But this will never happen under the slothful, unenterprising domination of the Turks.—*Engineering and Mining Journal*, xxiv. 423.

THE HUM-BIRD.

THE HUM-BIRD, OR HUMMING BIRD.

THE humming birds constitute the family *Trochilidæ* of tenuirostral birds, including the smallest and most brilliant of the whole feathered race. Darwin calculates that there are at least two thousand varieties of these lovely little birds, all belonging to the same family, but being in every respect distinct species. Of course, Darwin also believes they are all varieties sprung from one stock, but as it curiously happens that they never by any chance intermingle, or show signs of common origin, he has no more foundation for this than for any of the rest of his theory of the origin of species, which, to our mind, is the most loosely constructed, as it has been the most readily accepted, ever offered to the scientific world. But leaving this question for the present, it is beyond doubt that humming birds are the most beautiful and most varied in their plumage, as they are the smallest of all birds. Their native *habitat* is the vast continent of South America—there, and there only, are they to be found. They are—or rather were—most numerous in Brazil. We say were, for during the past few years they have, in many districts, been almost exterminated, owing to the vast numbers demanded by the fashionable ladies of London, Paris, and New York, as ornaments for their hair or dress. We are glad to learn that the Emperor of Brazil is determined to check this wholesale destruction, to some extent, by establishing a close time. In this country, too, Lady Burdett Coutts has placed herself at the head of a society, the object of which is to check, in some degree, the the comfort of their birds. Yet good birds demand good cages, for they are worthy of being displayed to the greatest advantage. The old breeders of the Canary distinguished as "The London Fancy" seem to have been a very painstaking class. Whatever objections may be raised to many of their arrangements, nothing can be said against their excellent breeding and flight cages. They have appreciated the importance of cleanliness, comfort, and the general healthfulness of these constructions, no doubt prompted by the difficulties encountered in breeding this remarkable but delicate bird. Such cages have been in use for thirty years, and after prevailing fashion for ornaments, the obtaining of which entails the wanton destruction of a life. The generic name is *Trochilus;* but as we have already said, the varieties are almost endless, and, therefore, would occupy far more space to catalogue than we could devote to the purpose.

BEAUTY OF NATURE.—I am never more convinced of the progress of mankind than when I think of the sentiment developed in us by our intercourse with nature, and mark how it augments and refines with our moral culture, and also (although this is not so generally admitted) with our scientific knowledge. We learn from age to age to see the beauty of the world; or what comes to the same thing, this beautiful creation of the sentiment of beauty is developing itself in us. Only reflect what regions lovely as Paradise there are over all Asia and Europe, and in every quarter of the globe, waiting to receive their fitting inhabitants—their counterparts in the conscious creature. The men who are now living there do not see the Eden that surrounds them. They lack the moral and intellectual vision. It is not too bold a thing to say that, the mind of man once cultivated he will see around him the paradise he laments that he has lost. For one "Paradise Lost," he will sing of a thousand he has gained. How every tender as well as every grand sentiment comes reflected back to us from the beautiful objects of nature! Therein lies their very power to enchant us. Nature is full of our own human heart. That rose—has not gentle woman leant over it, and left the reflection of her own blush upon the leaves and flowers? To the old man there is childhood in every bud. No hand so rude but that it gathers with the flower more and other beauty than what the dews of heaven have nourished in it.—*William Smith.*

HOW TO CLEAN ENGRAVINGS.—A correspondent has recently succeeded in cleaning some engravings by the following process: Soak the print in cold water till all creases are out and it lies quite smooth; then put into a dish containing a solution of chloride of lime with twice its quantity of clear cold water. When the stains have disappeared, put the engraving into plain water, and afterwards dry with blotting-paper. For the solution referred to, put half a pound of chloride of lime into a vessel with one pint of water; let it stand, stirring it now and again, for 24 hours, and then strain it through fine muslin till quite clear, when the liquid is to be added to one quart of water. The prints should not be left in the solution longer than is necessary to remove the stains, and the more thorougly they are washed in cold water afterwards the better for them; for, if any of the bleach is left in the paper, it is liable to rot and destroy it. The wet print requires care in handling.

The Weather and our Food.—Under the influence of the tropical weather we have experienced for some time past people are anxiously speculating as to the suitability of their diet for the unusual heat, and whether it should not be assimilated to that consumed by our countrymen in parts of the world where the ordinary temperature exceeds 90° in the shade. An adoption of some of the customs in vogue in hot climates is, however, to be carefully eschewed. What can be more conducive to heat apoplexy than "brandy panny," and highly curried and seasoned meats, so dear to the Anglo-Indian? Nature points out in this exceptional season that the lightest possible food should be taken, and that in moderation. Very little tea or coffee, plenty of milk, with fish, and but little meat, and that well cooked, and a moderate indulgence in iced drinks are indicated. Spirits and heavy wines are, of course, interdicted. It should be known that frequent and excessive thirst is often aggravated by an injudicious consumption of ice. Such extreme thirst will often be immediately allayed by hot drinks, a fact which has been often verified. It cannot be too strongly insisted on that over-feeding and over-drinking (of any fluid whatever) are more pernicious, especially either before or after prolonged or considerable exertion. The principal meal of the day should be taken at sunset.—*Lancet.*

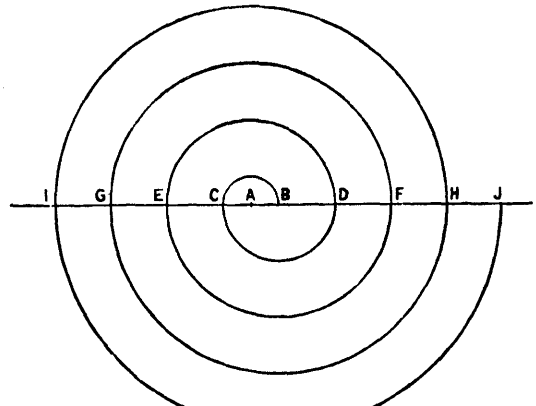
LIME-WATER KEEPING EGGS.—A very good way to keep eggs is to rub them once very lightly with butter, rolling them round in the hand, so that no part remains untouched. This method is a very sure one, as the eggs never get bad, nor do the shells become brittle, though with a large number of eggs it might not be feasible, on account of the trouble. A newly-laid egg, buttered, has kept for twelve months; at the end of that time, when cooked, it was as fresh as the day it was laid, even to the milk only to be seen in very newly-laid eggs. During the year the butter was wiped off twice, and some fresh rubbed on.

PLACING FERNS, &C., ON WOOD.—The surface of your painted wood must be quite dry, and made smooth with sand paper and of a good black, before putting on the leaves and the leaves must be quite dry and flat. Gum them on one side, and press lightly on to the article according to taste, using a clean fine cloth to press with. When dry put on with a clean brush best copal varnish. This should be applied as often as necessary to cover the leaves, allowing time sufficient for drying well between each coat of varnish. This is important to a good result, and also that only enough is used for each coat. The wardrobe should be placed down while being done

SPIRALS, &c.

A Spiral is a curve described about a fixed point, and which makes any number of revolutions round that point, without returning into itself.

PROBLEM 110.—To construct a Spiral, composed of arcs of circles of various radii.



1.—Produce **A B** indefinitely both ways.

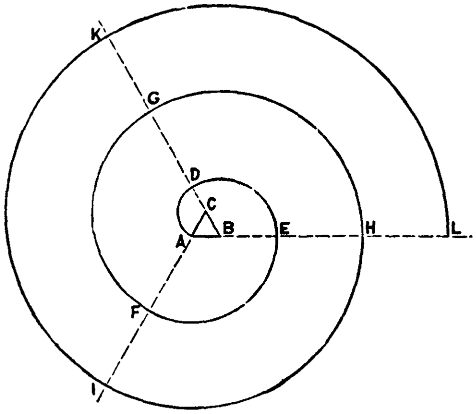
2.—With **A** as centre, **A B** as radius, describe a semi-circle, and let it meet **B A**, produced, in **C**.

3.—With **B** as centre, **B C** as radius, describe another semi-circle on the opposite side of the line, and meeting **A B**, produced, in **D**.

4.—With centre **A** and radius **A D**, describe another semi-circle, and again with centre **B**, draw the semi-circle **E F**, and so on, using alternately the centres **A** and **B**.

PROBLEM 111.—To Construct a Spiral composed of arcs of circles of various radii.

Another Method.



Let **A B C** be a small equilateral triangle.

1.—Produce its sides **A B**, **B C**, **C D**, indefinitely.

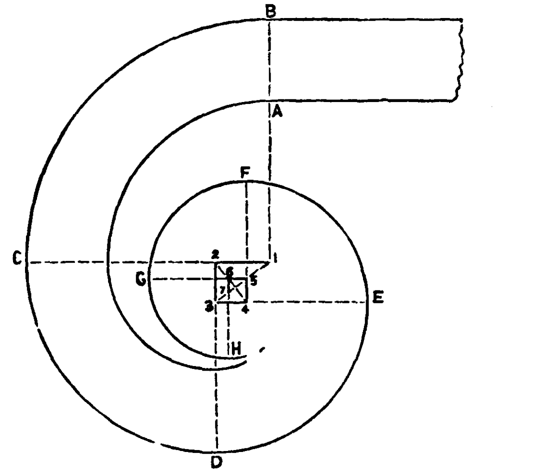
2.—With **C** as centre, **C A** as radius, describe the arc **A D**, meeting the side **B C**, produced, in **D**.

3.—With **B** as centre, **B D** as radius, describe the arc **D E**, meeting the side **A B**, produced, in **E**.

4.—With **A** as centre, **A E** as radius, describe the arc **E F**, meeting **C A**, produced, in **F**, and so on, using successively the points **C**, **B**, **A**, for centres.

Note.—From the preceding example, it is obvious that, by using any regular figure or polygon in the same manner for the initial figure, taking for centres the angular points of such figure successively in order, a varying Spiral will be formed. There is no limit to the possible number and variety of such curves.

PROBLEM 112.—To draw a Spiral Scroll adapted for Handrailing.



1.—Draw the straight line **1 B**, equal in length to three times the width of the rail **A B**.

2.—Draw **1 2** at right angles to **1 B**, and make it equal in length two-thirds the width of **A B**.

3.—Then draw **2 3**, at right angles to **1 2**, and make it equal to three-fourths of **1 2**, and join **3 1**.

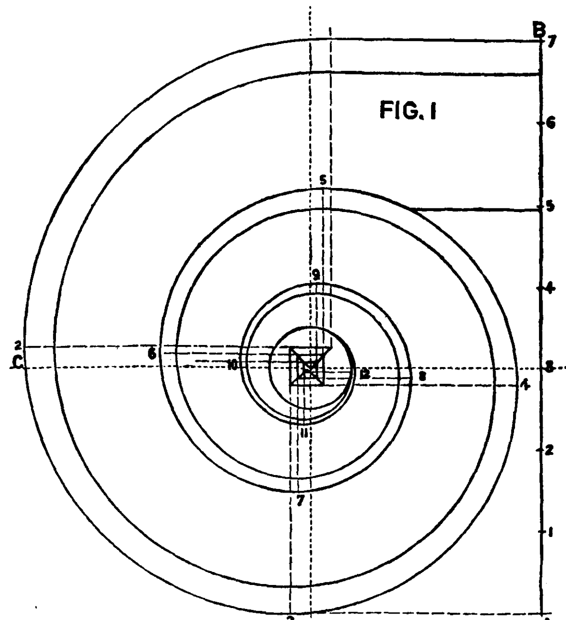
4.—Through **2**, and at right angles to **3 1**, draw the line **2 4**; then draw the line **3 4** at right angles to **2 3**, and cutting the line **2 4** in **4**.

5.—Then draw the line **4 5** at right angles to **3 4**, the line **5 6** to **4 5**, and **6 7** to **5 6**; the points **1**, **2**, **3**, **4**, **5**, **6**, are centres, from which the arcs of the scroll are drawn.

6.—Produce the lines **1 2**, **2 3**, **3 4**, **4 5**, **5 6**, and **6 7** indefinitely.

7.—From **1** as centre, **1 B** as radius, describe the arc **B C**, meeting **1 2**, produced, in **C**; from **2** as centre, **2 C** as radius, describe the arc **C D**, meeting **3 4**, produced, in **E**; from centre **3** draw the arc **D E**: from **4** the arc **E F**, and so on.

PROBLEM 113.—To draw the Spiral Scroll called the Ionic Volute.



PRACTICAL GEOMETRY APPLIED.—By J. Magnell.

PROBLEM 114.—To draw the Spiral Curve described by a point, upon a Cone, **A B C.**

If the points in the curve of a Spiral, in addition to approaching the centre in a constant ratio, are supposed also to rise above each other by a constant increase of height, a curve will be obtained, which is also called the Spiral. This Spiral may be conceived as a curve, traced on the surface of a cone. It may also be traced on the surface of a sphere.

Let **A′ 1, 2, 3, 4, &c.**, be points in the curve of the Spiral, traced on a horizontal plane, and **A B C** the given cone.

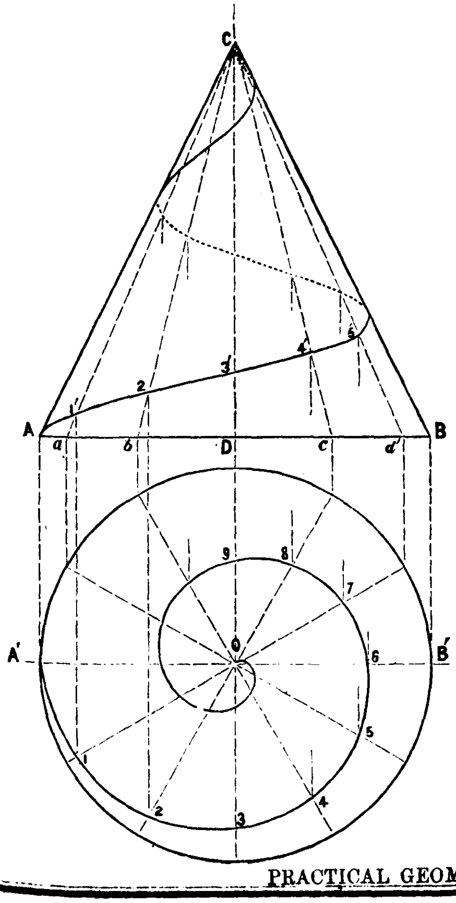
1.—From the centre **O**, describe a circle equal in diameter to the base, **A B**, of the given cone.

2.—Divide this circle into any number of equal parts, and bear in mind that the greater the number of those divisions, the greater will be the accuracy of the projection; and, through these points, draw radii, cutting the given curve in the points **1, 2, 3, 4, &c.**

3.—From the points in the periphery of the circle, draw straight lines parallel to the axis of the cone, **C D**, and cutting the base, **A B**, in the points *a*, *b*, &c., and from these points draw lines to the apex of the cone.

4.—Again, from the points in the curve where the radial lines bisect it, in the points **1, 2, 3, 4, &c.**, draw lines parallel to **C, D, O**, and cutting the lines *a c*, *b c*, &c., in the points **1′, 2′, 3′, 4′, &c.** These points of intersection are points in the required curve, and through which it may be drawn by a steady hand.

Note.—It may not be out of place here to urgently advise the student to learn and practice free-hand drawing at the same time that he studies the scientific portions of mechanical art. Many of the more difficult curves in Geometry, and numerous forms and shapes in mechanical and architectural drawing, can be far better and more neatly drawn in with the hand than by the aid of instruments or other mechanical appliances.



THE HELIX.

A helical surface is generated by the revolution of a straight *line* round the axis of the cylinder; its outer end moving in a Helix, and the *line* itself forming with the axis a constant and invariable angle.

PROBLEM 115.—To draw the Helical Curve described by a point **A** upon a Cylinder **A B C D.**

Let **A B C D** represent a cylinder upon which the Helix is to be situated, **E F** the axis, and **A 12** the pitch of the Helix.

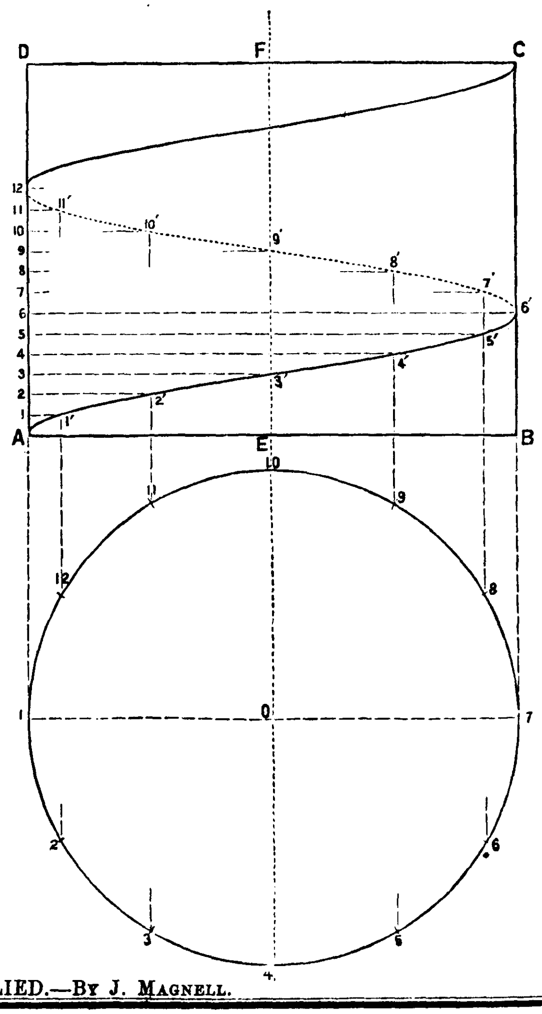
1.—Produce the line **E F**, and on it describe the horizontal projection of the Cylinder, **A B C D.**

2.—Divide the circle into any number of equal parts: the greater the number of these divisions the greater will be the accuracy of the curve.

3.—Set off, on **A D**, or any other line parallel to the axis, the pitch of the Helix as **A 12**, and divide it in the same number of equal parts as the circle is divided into.

4.—Then, through the points of division of the circle, draw straight lines perpendicular to **A B**, or parallel to the axis **F E**; and, through the points of division of the pitch, draw straight lines parallel to **A B**, or at right angles to the axis **E F.** The points of intersection of the respective pairs of these two sets of lines will be points in the required curve, as **1′, 2′, 3′, 4′, &c.**, and which may be either drawn in by the hand or by means of a template.

Vere Foster's Drawing Books—R 3.



PRACTICAL GEOMETRY APPLIED.—By J. Magnell.

Wrecking, Drainage, and Irrigating Pump.

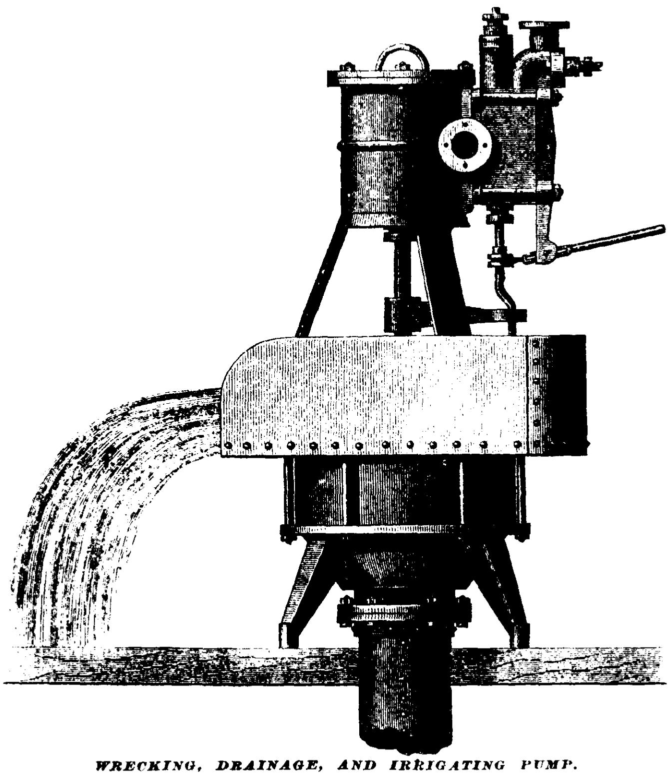
The adjoined engraving represents what is well known by the name of the Worthington Wrecking Pump. It is a direct-acting steam-pump, constructed in such a way as to obtain the greatest advantage of the steam practically available under the peculiar circumstances in which such pumps are to be used. It is a direct and single acting steam-pump, and the connecting flange, seen in the upper part of the engraving, has only to be connected with a steam boiler to have the whole in operation.

It is almost exclusively used by the New York Coast Wrecking Company, and by the principal wrecking companies of the whole Atlantic and Pacific seaboards. The large steamer Massachusetts, which last fall sank in the Long Island Sound, would have been a total loss without the aid of these powerful pumps, eight or ten of which were applied to raise her and bring her safely on one of the sectional dry docks in this city, where she was thoroughly repaired and made as good as new. Captain Merritt, of the wrecking company, maintains that it is not only the best wrecking pump, but in fact the only pump that is of any practical use in this kind of business.

It need scarcely be said that such a powerful pump is also well adapted for the purpose of draining low lands, of which there are hundreds of square miles all over the country, even within sight of New York city, which are now useless, but which, by proper drainage, could be redeemed and made worth millions.

For the same reason this pump is adapted for the opposite purpose—the irrigation of lands where, instead of having too much water, there is a deficiency of the same. Experience has always shown, that by the doubling and tripling of the crops in such localities, the expense of irrigation was always repaid manyfold, and even useless lands have been redeemed and changed into profitable agricultural districts.

For further information, apply to the Reading Hydraulic Works, of 87 Liberty street, New York, selling agents for H. R. Worthington, the manufacturer.



WRECKING, DRAINAGE, AND IRRIGATING PUMP.

Boiler Inspection.

At a recent meeting of the steamer and boiler owners in St. Louis, Mo., Mr. J. Marriot said that he was very strongly in favor of the hammer test, in which the eye, the ear, and sound all tended to make the test infallible. He regarded the hydrostatic pressure, as employed by the City Boiler Inspector, as weakening and dangerous. Under such inspection the boiler was tested when in a cold state, and the result could not be entirely satisfactory. The strain was harsh and severe, and the speaker, who had in his employ 156 persons, said that for ten or twelve days after the testing of his boilers by hydrostatic pressure he was always fearful of an explosion. He wanted the privilege of having his boilers tested in a manner that seemed best to him, and not be obliged to submit to the test imposed by the city. He looked upon the hydrostatic test as a more fruitful cause of explosions than anything else, and the city, by requiring its use, placed manufacturers in a sorry plight. It endangered the entire insurance upon their property.

Capt. Fitch, of the Harrison Wire Works, was equally strong in favor of the hammer test. In his experience in the United States Navy for twelve years, he had never seen hydrostatic tests used on board ship. The engineer made his own test with the hammer, and there were no regulations for any other test than this.

John Nolan, a boiler-maker, was opposed to the hammer test, and did not believe that it could be successfully applied, especially in small upright boilers.

Capt. Stephenson, of the United States Board of Inspectors, thought there was no test so satisfactory as that by hydrostatic pressure. It reached all parts of a boiler, and was sure to find a weak spot if there was one. It was impossible, he thought, to tell by hammer test whether a boiler would carry 40, 50, or 100 pounds of steam, yet by the hydrostatic test this fact could be arrived at. He employed the latter test, and had full confidence in its merits.

Col. J. W. Paramore, of the St. Louis Cotton Compressing Press Co., said that he had several instances to relate wherein the hydrostatic test had found his boilers all right, and the hammer test, applied immediately after, had developed most serious defects. His confidence was therefore seriously shaken in the test required by the city.

Jacob Tamm, of the St. Louis Wood Works, viewed the hydrostatic test as injurious. He had had a boiler tested by the City Boiler Inspector, and had received a certificate from the inspector of the good condition of the boiler. Two days later it developed a leak, and this he attributed to the hydrostatic pressure that had been applied.

Mr. E. Godard had been a steam user before the city required boiler inspection, and when the ordinance was passed requiring hydrostatic test, he had been fearful of results, for it was against reason to suppose that iron would withstand in all its parts the strain imposed in a cold state. He desired to elect how his boilers should be inspected.

A number of other interested parties also gave their views, and many more conflicting opinions were expressed. The meeting finally adjourned without coming to a decision.

If we wish to draw a conclusion from the above conflicting opinions, we must remember that experiments have proved (see page 274 of our December number for 1877) that wrought iron is stronger at the temperature of steam than when cold, and therefore if a boiler stands a certain pressure while cold, it certainly will stand the same pressure when hot. When it is said that boilers have been injured by the hydrostatic test, (and in fact we are personally acquainted with cases where boilers were actually made leaky by this test), we answer that the leaks were weak spots revealed by the hydrostatic pressure, and that it was fortunate that they were thus discovered in time. Of the value of the hammer test there can be no dispute, and we are consequently driven to the conclusion that both tests ought to be combined.

The trouble is, however, that the hammer test is difficult and laborious; nothing is easier or quicker done than to fill a boiler with water and apply a hydraulic pump until a certain degree of pressure is indicated by the gauge, or until the weakest parts give out; while the hammer test requires (what the government inspectors do not like) creeping into the furnace, or even into the boiler, and spending a certain amount of time until they find, or do not find, defective spots.

COMPARATIVE FIRE-RESISTING QUALITIES OF ORDINARY BUILDING MATERIALS.

From a paper recently read at the Convention of the American Institute of Architects, by R. G. Hatfield, we glean the following facts:

Brick possesses the best known fire-resisting qualities. Stone, though inferior to brick, is far superior to iron. Granite, when exposed to a very great heat, will crack and splinter freely. Marble is quickly reduced to lime. Sandstones disintegrate. Only those stones which are of volcanic origin may be safely trusted in fire.

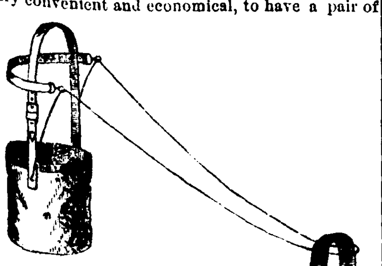
The extensive use of iron as a material of construction is of recent date, yet the experience, especially at Chicago and Boston, has materially lessened confidence in its fire-resisting character. Wood is generally supposed to have the least power to resist fire. This idea in the main is correct, and yet under certain circumstances wood will stand fire longer than iron. Firemen are rather reluctant to enter a burning building which has iron supports, yet do not hesitate where they are of wood. A floor of wooden beams placed apart in the usual way has but little fire resisting quality. The fire, aided by a current of air between the beams, rapidly consumes them. In order to remedy this defect in the construction of wooden floors various devices have been used, one of which is the use of thick coatings of plaster or gypsum upon the lathing at the bottom of the beams, and also to extend them up on each side. This forms a good filling and will prevent the passage of air, but induces a rapid decay of the timbers, and besides the fillings produce too much weight. If some filling could be used which would support itself, such, for instance, as wood, or if the intervening spaces were filled with additional wooden beams, so as to make the flooring one solid mass and shut up all air passages, such floor would resist the action of fire for hours. But then wood is subject to decay, and some remedy might be devised to prevent this decay before the above method of building floors would be satisfactory.

A Cool Cellar with a Well.

The space above an ordinary well is not only lost, but frequently gives opportunities for the admission of vermin or of surface water, with whatever impurities may be contained in it. There is no necessity that a well should be open to the air, on the contrary, the more closely the water is confined, the better it is. The best of all wells are the driven wells, which are simply enlargements of the underground water-channels, having no connection with the surface, except through the pump tube. In some places it is a common practice to use the upper part of an ordinary well as a milk cellar, having steps to go down into it, and shelves upon which to place the milk pans. This is a dangerous and uncleanly practice. A correspondent from Pennsylvania, who has come into possession of a farm having a well so arranged, asks how to improve it at the least cost. As we know of several such cases, we have prepared the engraving on page 380 to show a plan for their improvement. The well should be arched over solidly with brick or stone, and cemented upon the top. It may then be covered with earth, leaving a space at one side for the pump tube to go down. The excavation may then be enlarged, and the walls bricked or stoned up, making a cellar. The floor may be cemented or bricked. A low shed may be built over the cellar, as a roof, or a complete building having a floor may be erected, and serve for a store-room, or an outer kitchen in which the pump is situated. In this case a doorway into the cellar and steps leading down are made. The well will then be cut off from the surface, and the space above it properly utilized. Except in cases where, as sometimes happens, quick-sand works into the well and gradually fills it, requiring an occasional removal, the lower part may be covered as here recommended.

A Nose-Bag for Horses.

When field work commences, it will be found very convenient and economical, to have a pair of



NOSE-BAG FOR A HORSE.

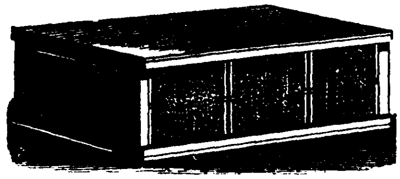
nose-bags for each team, in which a light feed may be taken to the field, to be eaten during a few minutes' rest in the forenoon. When doing hard work, frequent light feeds are much better for the team, than a few heavy ones. A horse has rarely sufficient opportunity in a hasty dinner-time, to eat enough food, and a full meal will interfere with his work, or his work will interfere with the proper digestion of a full meal, and either is injurious to the animal. A nose-bag for field use is shown in the accompanying engraving. It is made of canvas, with straps of leather; the straps being made in the shape of a head-stall. To enable the horse to reach his food, without resting the bag on the ground, a cord is passed through rings in the front band, and attached to the saddle. When the horse reaches out his head, to procure the food, the bag will be drawn up by the action.

Preparing Honey for Market.

The form of the package that contains liquid honey will vary in different markets, yet one rule should always hold good. Whatever its size may be, (whether jelly cups, fruit jars, pails, or cans,) let the package be such as will be useful to the purchaser after the honey is consumed. A few seasons ago we used a large number of fruit jars of inferior quality, because of their cheapness, and the result was that all honey put up in standard jars sold first, and some of these inferior cans had to be emptied into flour pails before the honey could be sold. Some markets call for small packages, even as small as one pound or less, while others will call for larger ones, from which to retail in such quantities as may be desired.

I believe that when the process of removing honey from the comb by centrifugal force is more fully understood, and its perfect purity is appreciated, honey in this form will be more generally called for. In cold weather it candies, becoming very hard, in fact so hard that when very cold, it may be cut from a tub with a knife, and dealt out in a paper as readily as butter.

If box-honey is to be transported any distance to market, it should be properly packed in cases for that purpose. The number of boxes packed in a case will depend upon their size. Cases should not contain over 50 lbs. each. The ends of the case should be of basswood, and top and bottom of pine, if preferred. The sides of the case should be left open to show the honey, with



PACKING CASE FOR HONEY.

simple strips an inch wide, nailed across the top and bottom, as shown in the engraving, to keep the boxes in place. Two ends, with a handle on each, a top and bottom, and four inch-wide strips are required for each case.

Hitching a Crib-Biter.

A correspondent who has a horse that is a crib-biter and windsucker, and which practices his vice when hitched to a post in the street, is recommended to try a hitching-rod, such as is here illustrated. It consists of a piece of hickory, white oak, or tough ash, about 24 or 30 inches long, thickest in the middle, where it may be an inch in diameter. A ferule with a ring is fastened to each end; in one ring a common snap-hook is fixed, and a short leather strap is passed through the other, by which the stick is fastened to the post. The horse thus hitched can not possibly reach the top of the post, to seize it with its teeth. In the stall such a horse should be hitched with two straps, one at each side of the stall, and of such a length, that he can not reach either side, to take hold of the rail or partition of the stall. If a swinging feed-box is used, such as is described in the *American Agriculturist* of January, 1875, and which, when not in use, is brought into the feed passage, leaving nothing inside the stall to take hold of, the crib-biter will be forced to suspend operations, as he cannot draw in the air or "suck wind," unless he has some projecting object that he can lay hold of with the teeth.

Dried Tomatoes.

Housekeepers in the country, who have many tomatoes and few cans, can easily preserve a large quantity of this very easily raised fruit, by drying it. This method requires little outlay, and comparatively little trouble. Scald and peel the tomatoes, as for canning. Boil them slowly in a porcelain kettle or stone jar, until the original quantity is reduced one-half. Then season them in to proportion of a teaspoonful of salt, and half-a-cupful of sugar to a gallon of stewed tomatoes. Spread on plates and dry quickly, *without scorching*. As the moisture dries away and the stewed fruit takes shape, scrape it up so that both sides may dry, and let the contents of several plates, heaped up lightly, stand in bright sunshine a little while before putting away. Store in bags and keep dry.

When wanted for use, put a small quantity soaking in considerable water several hours, or over night. Stew in the same water long and slowly—three or four hours—keeping boiling water at hand to add if it grows thick, and so is in danger of burning. It should be quite thin when done, and may be thickened with bread crumbs, and seasoned with a little sugar, salt, and butter—of course tomatoes should not be made sweet. As to sugar in tomatoes, tastes differ greatly; we know a few persons who habitually use sugar upon the cooked fruit; for ourself, the least particle of sugar is at once detected, and the dish is spoiled. We should as soon think of putting salt upon strawberries as sugar upon tomatoes. Ed.]

Driving Troublesome Insects Away.—The dissemination of science and a better knowledge of entomology is all that is needed to keep free from the pest of troublesome insects. A contemporary says: "I have not seen a bedbug or a flea in my house for many years. If an army of them were to be brought in, mercury would speedily exterminate them, but I think cleanliness is the best and perhaps the only preventive. The common house fly I do not molest, believing that it more than compensates for its trouble by clearing the atmosphere of effluvia and the animacules which always arise from the putrefaction of decaying substances during the warm weather. So with the birds, which are quite numerous here during the summer."

Lightning Figures.—A young man named George Boner, while ploughing corn near Newark, Ohio, was struck by lightning and instantly killed. A bluish black discolouration of the body extended from the neck to the hips. On his breast was found engraven the likeness of a large tree which stood within a short distance, the branches of which projected naturally to each shoulder, forming a representation so perfect as to render the leaves plainly visible.

For prevention of boiler scale Herr Clouth employs a caoutchouc lacquer, which prevents the adhesion of the sediment to the walls of the boiler, so that the scale can be easily removed. After the scaling the boiler is left bright and smooth. The lacquer does not injure the iron, for its ingredients are only linseed oil and india-rubber.

Something about Dragon Flies.

It is not to be wondered at that several young people should wish to know something about Dragon-flies, for they are among the most noticeable of insects. Their long slender bodies, their large heads, with prominent eyes, and their wide spread, gauzy wings, which reflect beautiful colors in the sunlight, are sure to attract attention. More than all, their rapid flight, now darting with the greatest swiftness, then remaining stationary over a spot, and then as suddenly moving backwards, gives them a mysterious air that no other insects have. It is no wonder that they have been looked upon as harmful insects, for they go about in a silent, strange way, as if there was some mischief to be done. There are over 400 kinds of Dragon-flies, found in various parts of the world, of which we have our share in this country; about 30 are known to live in the Northern States, and there are others in the South, but while they differ in size, color, etc., all have similar ways of living, and a description of the habits of one, answers for all. While their long, snaky bodies, their savage look and their darting flight, make them suspected, and they are generally looked upon as dangerous, I may as well say here, and answer several questions at once, that they are perfectly harmless, so far as man is concerned. They have no piercer or sting, and though the larger ones may be able to pinch with their jaws, if you put your finger there and try to make them do it, they do not bite, sting, or otherwise harm people in any manner. I know that they have a bad reputation. When I was a youngster, they were called "Devil's Darning Needles," and I was told by the older boys that if a boy should tell a fib, one of these "Darning Needles" would come and sew up his mouth. All my playmates must have been very truthful, as I never saw one with his mouth darned by one of these "Needles." But such notions are not found among boys alone; in various places these insects are called by names which show that they are thought to be dangerous. In England they are called "Horse-stingers," and in Scotland "Flying Adders." In some parts of this country they are known among the boys as "Snake Doctors," it being thought that they attend upon snakes, probably because they are seen hovering over the ponds where there are water-snakes. On the continent of Europe they have more pleasing names. In France, they are *Demoiselles*, or "ladies," and in Germany *Wasserjungfern*, or "Virgins of the Water." In traveling in the Southern States, I had heard them often called "Mosquito Hawks," and was told that they devoured so many mosquitoes that it was considered wrong to kill one of them. At last I had an opportunity to learn that, for once, a popular notion was correct. One excessively hot day in June, I happened to placed. If you put them in an aquarium, there will after a while be little else left, at least of the smaller inhabitants, for they attack creatures much larger than themselves. It is difficult to say which is the most curious in the "Water-tiger," (which is a convenient and shorter name for the Dragon-fly larva), its head or its tail. Curiously enough, the creature breathes through its tail! You no doubt know that fishes breathe through gills placed in the head, and as the water flows over these, they take up the air that is dissolved in the water, and thus carry remaining apparently lifeless for some time, and at length break their enclosing shell or skin, and come out a perfect butterfly, moth, or beetle. But the Dragon-flies are quite too busy to keep still, and even in the pupal state are as lively and greedy as ever. They change their skin, and show by a hump, where their future wings will be, and the eyes of the perfect insect may be seen under the skin, but as to keeping quiet, it doesn't know how. At last its time comes, and the pupa crawls up the stem of some plant, and leaves the water forever. Instead of

THE LIFE HISTORY OF THE DRAGON-FLIES ILLUSTRATED.

be on Lake Ponchartrain, not far from New Orleans; there were several pleasure houses, to which the people came from the city in the cool of the evening for a drive, and for ice-cream and other refreshments. These places were mere sheds, or shelters, and on the inside of them were mosquitoes by the million, resting in the heat of the day, to be all fresh to receive the evening visitors. I never before, or since, saw so many mosquitoes, for they were so thick as to make the sides of the building look gray. There were also hundreds of Dragon-flies—good, big fellows—which flitted about and fed upon the mosquitoes at such a rate, that I saw at once that they were well named "Mosquito Hawks." When we see these insects so busy darting here and there, they are no doubt hunting for mosquitoes and other insects upon which they feed. The engraving shows one of the Dragon-flies on the wing, and gives an idea of the general appearance of all, though many are much smaller in the body, and in spread of their wings. But the early life of the insect is quite as interesting as that of its perfect or winged state. The female insect places her eggs upon the stems of water plants, just at, or below the surface, and from these hatch out the *larvæ*; or the first form of the insect. The larvæ of the butterflies and moths we know as caterpillars, and that they live on plants on the land, but the larvæ of some insects, including the mosquitoes and Dragon-flies, live entirely in the water until they are ready to change into perfect insects. The larva of the Dragon-flies is sometimes called the "Water Tiger," and well deserves that name, for it is one of the most voracious of living creatures. The insect in the water at the lower part of the engraving—the one directly in the center—shows the larva as it usually appears. These "Water Tigers" may be found in pools and muddy ponds, and in still places along the margins of rivers, and, though not handsome to look at, they are very interesting to watch. If you wish to study their ways, you can easily catch them with a small net, and put them in an aquarium, or what is better, a jar by themselves, in which some water plants are on a slow kind of breathing. But in the "Water-tiger" its gills are placed near its tail; it takes in water there through an opening, and forces it out again, and that is its way of breathing. But this opening answers another purpose. The animal crawls quite slowly, and as it is a great feeder, it would not get much food, did it depend solely upon its legs. If you watch one of them in search of food, you will be surprised to see the sluggish fellow dart for its prey with the greatest speed, and this motion is one of the many strange things about the creature. Ordinarily the water passes out of the opening in the tail quite slowly, but when necessary, the insect can force the water out with a sudden squirt, and that pushes it along through the water with great swiftness, upon the same principle that a rocket is sent through the air. Not less curious are the arrangements at the other end of the insect—at the head. As usually seen, it appears as in the figure at the middle of the lower part of the engraving, a quiet and rather harmless looking larva. But let a small insect or other animal come within reach, and, presto, the mild looking fellow shows a savage pair of pincers, and becomes the very tiger-ish animal seen in the right-hand lower corner of the engraving. This arrangement for taking its prey is called a "mask," and when not in use, is bent down under the head of the insect, and quite out of sight; it is so arranged that whatever is caught by the jaws of this mask, is brought, when that is folded under, right opposite to the true mouth of the insect, where it can be eaten. These Water-tigers not only prey upon other water insects, but even devour small fishes, and seem to live only to destroy and eat other living things. They go on feeding and growing, some one year, and some, it is said, for two years, when the time comes for them to change to perfect insects —to leave the water, and begin a new life in the air. You know that when caterpillars and most other insects—as I have shown you on several occasions —make this change, they go into the pupal state, and either spin a cocoon, or form a chrysalis in some way, breathing the water through its tail, it now has to breathe air through openings in its sides, and instead of propelling itself, rocket-like, through the water, it has to dart through the air, and for this it must have wings. All these are provided. The pupal skin at last bursts, and the perfect Dragon-fly slowly pulls itself out, as you see at the left hand of the engraving. At first the wings are damp, limp, and useless, but they gradually spread and dry—and what beautiful wings they are! They are worth a close examination; see the delicate frame-work, so curiously netted, with a beautiful membrane filling the spaces between; this is wonderfully thin and transparent, and the light often plays on it with rainbow colors. Can anything be more complete than this transformation—from an ugly inhabitant of muddy water, to a light and graceful creature of the air! But there is one thing which the Dragon-fly does not leave behind him with the remains of its former life—he has his appetite, and skims away through the air, devouring other insects, quite as effectively, as it did before as a "Water-tiger." There is one thing about the perfect insect, you will not fail to notice—that is the great eyes, or rather masses of eyes, as the microscope shows them to be; these, while the insect is alive, have beautiful colors; besides these, there are three little single eyes, usually placed in a row on the front of the head. So far from the Dragon-flies being dangerous, we may look upon them as not only harmless, but so far as they destroy mosquitoes, as really beneficial insects—at any rate, I hope that I have shown you that they are really interesting ones. I have said nothing about the scientific names of these insects, their being several different genera, or kinds, and only those who study entomology, will care to know the systematic names, but it is well to know that these belong to the division or sub-order *Neuroptera*, which means nerved-winged, and includes, besides the Dragon-flies, the May-flies, the Lace-wings, and besides others, the Caddis-flies, one of which I told you about, as the insect that builds a stone-house.

THE DOCTOR.