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SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

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HINTS TO THE EMPLOYER.

We have, as a general rule, directed our remarks on technical education to the employed. A few words of advice, now, will not be out of place to the employer. It is as much to the interest of the employer to have around him skilful and well-trained workman, as it is to the employed to become such, their interests, in fact, lie closely together, and there can be no doubt but that employers should, in duty to themselves and the public, take an interest in the training of their helpers, and see that the boys in their establishments, learning trades, are not kept in ignorance, but that they receive careful instruction and drill, so that they may grow up to be skilful workmen and good men. Any workman, when he has acquired a skilful knowledge of his trade, has a self-respect which otherwise he would fail to feel, and then he is not as likely to be led away into strikes for higher wages, at periods of commercial depression, as those are who have skill and who would fain enjoy the same wages as another worker at the bench, who can do his work better and in half the time of the unskilful man. When bad times come it is the skilful and good men who are employed, even although wages are low, because, as a general rule, they are good men. There are some very skilful mechanics who are dissipated, it is true, but such, also, we frequently find to be the case in the highest spheres of intellect; they are but exceptions to the general rule.

Employers should spare no pains to teach their boys. The foremen should also take a similar interest in the youth placed under their charge, and not say, as we have frequently heard said, "I had to find out knowledge for myself, let them do likewise," this is a very selfish feeling. We have invariably found it to be the case that all eminent men have been particularly liberal in imparting their information to others. Everybody in a factory ought to undergo, periodically, a catechetical examination on the principles of his trade, and such things as he did not clearly understand should be explained to him. Young beginners should not be discouraged by a want of communicativeness on the part of a foreman, and the employer should take pains to encourage boys to ask questions, so that they may learn the why and wherefore of what they see in daily practice. Many boys are too diffident to ask questions, fearing it may be considered impertinent, or afraid to show an ignorance of what they might be supposed to understand; to such lads, a little kind encouragement would advance them rapidly in a knowledge of their trades. A celebrated Italian, when once asked how he managed to obtain such an immense amount of varied information, replied, "by not being too proud to ask a question when I was ignorant."

Employers have it in their power to assist most materially in the education and welfare of those they employ, and it should never be forgotten, by either employer or employed, that there is a connecting link, of mutual interest and good, between them that should on no account ever be severed.

ENCOURAGEMENT TO INVENTORS AND INVENTORS' FOLLIES.

A good deal has been written lately about the discourgement inventors meet with from the first conception of their idea until the issue of the patent, if it ever is issued. The inventor has nearly as many stages to go through as Shakespeare has given to the life of man. First is the dawning idea, seen through a mist or fog, in which the image is indistinct and undefined; often it is but a mirage, a mere atmospheric deception of the brain and never assumes any tangible shape whatever, and just as you think you have it, it disappears, like a Will-o-the-Wisp. Even when caught it has to be worked into many shapes and undergo many trials before the inventor feels that his babe is strong enough to be launched into life. For awhile he is wrapt up in the consideration of the great value and importance of the thing and the money that is in it. About this stage, he is seized with a sudden fear that some one may forestal him in his idea, or, that the secret may be stolen from him, and then he is in all haste to have it patented; but now comes another terror on his mind, where can he find an honest Patent Agent to whom he can entrust his invention? Can he even trust the officials at the Patent Office? Is there not a clique there, who band themselves with patent brokers, and whenever they see a valuable invention such as his, keep back the knowledge of it, until they convey the secret to another party who pays them a handsome sum? Is there not, he thinks, a dozen ways in which venal clerks can rob him of his treasure? This is a very severe period of the patent fever, during which the patient is generally in a state of wild delirium. After the paroxysm has somewhat subsided, he feels that he cannot prepare the specification and drawings himself, he must have some one to take out the patent, and then too often he makes a hasty choice. Here then comes in a very peculiar phase of the disease; hitherto he has been in a state of nervous excitement, lest any person should surreptitiously steal his idea, but no sooner has this subsided than a reaction takes place, and he goes off with his model under his arm, and chooses for his solicitor—not the most upright man, or one of the most practical ability, but the one that will do it *cheapest*. Having deposited his model and given instructions to his solicitor to *claim everything*, by which he means the very elements themselves, if necessary, for a few days he will fall into a quiet calm, and indulge in castle-building to a great extent. A great difficulty arises in his mind at this stage as to the lowest sum he shall accept for the patent, or whether he shall dispose of it in Royalties, or, whether he shall work the invention himself and keep the monopoly in his own hands; but, should he be of a philanthropic turn of mind he may deem it charitable and christian-like to give it to the world in such a way that its benefit will be enjoyed in the shortest period of time; he may be willing even to lose a little for this laudable object. From this delectable state of mind he is aroused by the receipt of the specification, and to his astonishment finds that he can only claim, as original matter, but a few of the working parts of his machine and that the other claims were common property to all, and that he can only claim them in connection with one or two original improvements. After a good deal of discontent to himself and worry to his solicitor, who ultimately gives way and tries for some things he does not expect to get, just to ease his client's mind, the papers go to the patent office; the inventor feels now more resigned, and rather chuckles over the idea that those old and tried experts, the Examiners, will overlook the little claims that he has had inserted in rather an ambiguous way, that they might not appear too striking, he thinks they may slip in among the main points and not be noticed. The application having been forwarded and the receipt of the first fee acknowledged, week after week passes away and no further notice is taken of it—the inventor, if he had any doubts before about the honesty of Patent Office officials, that is, he did not think them *all* rogues, but now he is certain they are or there never would be so much delay if some one was not stealing his invention or this vexatious delay was merely to gain time for another person to forestal him. He casts severe glances at his solicitor, and throws out some sarcastic hints that there must be something wrong somewhere or his patent never would be delayed so long. After a delay of about six weeks, during which time the inventor has lost several pounds of flesh from worry, and those investments he had in his mind's eye are slipping away, a short memorandum comes back to his solicitor to inform him what he knew would be the case,—that the claims are too broad, or, perhaps, that they interfere with previous inventions. About this time the nervous irritation of his client is assuming a chronic form, he is seldom seen to smile except in a sickly, ghastly way, and looks frequently as if he wanted to cry. He begins to think that his solicitor is incompetent and that if he had put the patent into another party's hands even had he paid more, it would have been wiser. He thinks too that his solicitor has no private influence with the commissioner, if he had, a private note ought to have a settled the business at once. However, there is now no help for it, the broad claims are withdrawn, as well as those that interfered with other inventions, and the poor applicant finds that his invention robbed of all its borrowed plumage is a very sorry looking bird indeed. Sometimes he is informed that the thing is old, or impracticable, or not useful, and the patent is refused; but even in such case he never feels so bad as when his patent is stripped of other people's inventions.

But, even in case that the inventor obtains all he claims, and a patent is granted, how few indeed realize their hopes of profit—not one in a hundred. Too often is money and valuable time lost in endeavoring to carry out ideas of no practical benefit.

Now this brings us to a point where we can bring in, we trust, some useful advice to Canadian inventors of that class who too frequently put themselves and their families to a great pecuniary inconvenience, to take out patents that are perfectly worthless that can never be of any practical utility.

We do not address ourselves to those who can afford both time and means to indulge their inventive faculties, but we do speak, in all earnestness, to a large class of artisans who too often are put to great straits to obtain the means to take out a patent that can be really of no practical use.

Among other measures that we are bringing to the consideration of the industrial classes, we propose that to all members of Mechanics' Institutes pecuniary assistance should be granted to take out a patent, provided a committee of practical men considered the invention was really of a useful character; this would give the inventor time to realize on his invention, and his family would not be put to inconvenience for want of the money used for such purpose. It would also enable a man, who had really some useful invention laid by because he had not the means to take it out, to give the benefit of it to the world, and it would also stimulate others to put their ideas into shape from the knowledge that if their invention were really practical they could obtain assistance to patent it; of course if the money was borrowed from the resources of the Institute, legal interest would have to be paid and a certain security given, but no poor man would be necessitated to give up the half, of perhaps a valuable patent, for the sake of the loan of a few dollars to pay the patent fees. We are at present strongly urging the necessity of Canadian mechanics coming to the front and taking an active interest in Mechanics' Institutes, and, if they do so, most assuredly they will in a very short period reap the benefit.

New Publications.

LOVELL'S ADVANCED GEOGRAPHY.

Just published by JOHN LOVELL & SON, Montreal.

Canadian Literature and Education owe more to Mr. John Lovell than to any other publisher in the Dominion. What the late Hon. John Young was to Canadian Enterprise, Commerce, and Navigation, Mr. Lovell has been to literature and education. The former gentleman saw in Canada a great country in the future, and if he did not live to see all his projects for its advancement carried into effect, at least many of them were completed in his lifetime—of which the last and greatest was the conception of the Victoria Bridge—a monument of lasting fame to his memory.

What Mr. Lovell has done for literature and education in Canada is a parallel to the biography of Mr. Young. He has devoted his lifetime and his purse to the cause, and to the encouragement and help of young authors. We can scarcely realize the value of some of his publications, because we constantly have them before us for reference; were they not in existence where could we seek for the valuable information they contain?

The "Advanced Geography," is a most accurate work and interestingly illustrated; the letter press is exceedingly clear, and the maps beautifully executed and not over crowded.

In preparing this work for the country we are aware that the best talent has been engaged, and the greatest care taken to ensure correctness.

The Educational Departments, and the public owe much to the enterprise of Mr. Lovell in publishing this excellent work, which we have no doubt will be brought into general use in every school of the Dominion where the English language is taught.

UTILIZATION OF WOOD SHAVINGS.—From wood shavings and paper Herr Heileman makes plates, dishes, etc., as follows: Selected plane shavings are bound into bundles, and steeped in a bath of weak gelatine solution about 24 hours, then dried and cut into suitable lengths. Plates are cut of strong paper or thin paste-board, of the size of the objects to be produced. These are moistened with a liquid consisting of weak gelatine solution with soda waterglass and pressed in heated metallic molds. After drying, the pressed paper objects are coated on both sides with an adhesive material made of five parts Russian gelatine and one part thick turpentine; the shavings are applied to them and the whole is subjected to pressure. Wood shavings alone would, because of their unequal thickness, present uneven surfaces. The objects are now cut, if necessary, dried and varnished.

INSANITY A BOON.—A German physician considers insanity in the light of a boon. This is certainly a novel view. He holds that the loss of reason lands the sufferer from a sea of trouble into one of comparative calm.—often into one of decided happiness; and attempts to restore such a person to sanity would be cruel rather than kind. Moreover, he insists that without a certain amount of insanity success in life, the ordinary acceptation of the term, is quite impossible. All emiuent men, he contends, are decidedly more or less mad. Many of them are dangerous monomaniacs whom it would be decided on public grounds to shut up, but who nevertheless achieve grand careers, and are credited with doing a vast amount of good. The false notion he attributes to the fact that the greater mass of mankind are also insane, and quite unable to distinguish between good and evil.

Mr. Sutton, who proposes to erect a cotton factory in London, Ont., asks the city for a bonus of $50,000, and says that he intends to form a joint stock company with a capital of $300,000. It is likely that the city Council will submit the proposal to the citizens.

THE BEET-ROOT INDUSTRY IN FRANCE.

It will be interesting to our agricultural readers to read the following description of the cultivation of the sugar beet at "La Briche" farm, in France, which we copy, together with illustrations, from a journal r-cently published on "sugar beet" by Messrs. Henry Carey Baird & Co., 810 Walnut street, Philadelphia; and we recommend all interested in the culture of beet root for manufacturing sugar to obtain this excellent work, which will give the experience of all interested in this important growing business.

"LA BRICHE" FARM AND DISTILLERY.

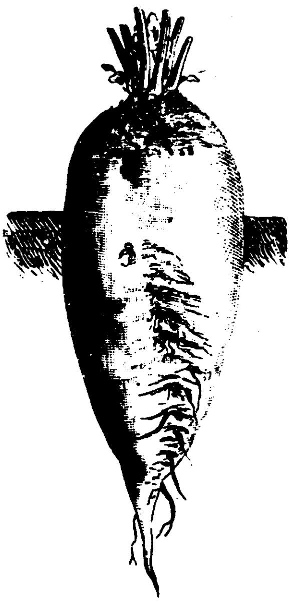
(See page 301.)

When the French paid one thousand millions of dollars indemnity to the Germain Empire after the Franco-Prussian war, it was generally thought that their financial stability would be disturbed, and that, for years to come, unknown principles of economy would necessarily be introduced; and that, notwithstanding their previous prosperity, serious changes for the worse would take place. It was predicted that no nation could survive if its treasury were called upon to pay within such a limited time gold coin to the amount above mentioned. None of these prophecies proved true, as they were based on general principles, from the local point of view of the other nations. France to-day is apparently and actually as rich as ever. Her government is at present spending millions upon its army, navy, improvements and fortifications. The late International Exhibition was considered equal, if not superior, to any previously held in that country. But whence comes the money to do this? We answer, from the *farmers*, who represent the true wealth of the country. The greater number of them, since the French Revolution, own some few acres of land, on which small crops are raised at modest but satisfactory profits. Whatever these profits be, only a portion is spent, as the importance of providing for the future is one of the earliest principles taught the French peasantry. If a new government loan be issued, it is bought by the masses throughout the country with the money so deservingly saved. Monopolies in the purchase of government securities do not and, perhaps, cannot exist. The farmers and populace at large have a chance, and look forward to it by waiting and sleeping days and nights at the doors of the exchange office; and when these are opened, they exchange their small gold coins for the three or four per cent. government bond. The fact of realzing a profit on a few acres of land which at the same time supply the daily needs of the owner or tenant, is beyond the comprehension of the average American tiller. On the one hand, with a soil naturally yielding comparatively little, money is saved; on the other, extraordinary crops, and frequently the rents have not been paid. The explanation of this is, that in France the most painstaking care is given the soil, and improved methods of cultivation are continually being introduced through the exertions of the government agricultural colleges located in various sections of the country. We know of no better illustration of the numerous farming changes that may be brought about, depending upon intelligence, perseverance, economy and money—and are of frequent occurrence in Europe, than the history, past and present, of the "La Briche" farm and distillery shown herewith. This farm, situated on the river Loire, and in the department of "Inde et Loire," was purchased by Mr. J. F. Cail, in 1851, for two hundred and fifty thousand francs (50,000), and was then mainly marshes with any quantity of stagnant water, rendering the entire neighborhood unhealthy. The swamps in question were divided into two parts, called respectively l'Hommes and Rille. The surrounding small farms were then worthless, or nearly so, and could be bought for about forty dollars each. Mr. Cail called the farmers' attention to the fact that their land was good, but their manner of working was not what it should be. The new owner of "La Briche" farm commenced his improvements shortly after purchasing; the first operation being to uproot some twenty-five thousand trees, thus exposing the soil to the action of the heated sun-rays, air, etc. Draining the water from these swamps was no easy task, as miles of small canals had to be dug to receive the discharge from the system of drain-pipes. The total number of these of all sorts was eighty thousand, and the cost of this drainage alone amounted to $20,000. This preparatory farming outlay would have frightened many, but it must now be said that the neighboring tillers realized its importance, and followed the example set them, with the effect of increasing the value of their previously worthless land. The price was raised from forty to eight hundred dollars. The total number of acres now worked at "La Briche" for farming purposes is two thousand, yielding sufficient beets to supply the distillery for a hundred days at a hundred tons per day; also a grain crop sufficient to supply three hundred laborers with food. "La Briche" farm has numerous roads and woods, and the most important of the first is shown in the illustration. On each side trees have been planted, rendering the street to the distillery most attractive. Before entering, we pass over a good-sized ditch, which receives the drainage of the enclosure which it surrounds. On entering we pass "Porte d'Hommes," and find an immense yard 450 feet in length and 165 wide. To the right is a large building, the upper stories of which are for the storage of grain, the ground-floor being occupied by the offices of the overseers. Each floor of this building has an area of 4,320 square feet, or, for the three floors, a total of 12,960 square feet, sufficient for the storage of 1,000,000 litres (or about 35,166 bushels) of grain. This building cost $12,000. On each side of it may be noticed two covered sheds used for housing the farming implements. On the left, after entering the before-mentioned yard, may be noticed three structures which are each 196 feet in length and 85 feet wide, and have a total capacity for six hundred head of cattle. The space between the buildings is a manure-yard. There is a most excellent arrangement for the cattle in the interior. The animals are arranged in four rows. The pulp from the distillery is received in cars that circulate upon tracks visible in the figure, in front of their stables. These stables cost $100,000.

The large circular structure on the left of the entrance is a sheep-fold, having a capacity of four thousand animals, and costing $7,000 to build. The distillery is of considerable importance at "La Briche" farm, and the three buildings clustered at one corner of our illustration give the reader an idea of its importance. Alcohol marking 96° B is made, and pure enough to be used in the manufacture of quinine and numerous other chemicals where a solvent is required. The beet-distiller is in France a public benefactor, as the manufacture of alcohol from the beet keeps down the price of almost every article sold in pharmacy, and thus enables the suffering poor to relieve their pains at a low figure. The pulp required for feeding would otherwise be a waste product, and hence is an important factor in the profits.

Besides the buildings mentioned as being within the enclosure, we find others devoted to the cooking, gas manufacture, etc.

In conclusion, we can say that the entire working of "La Briche" farm came nearer to the desired standard than any other of which we know; and much credit is due Mr. Cail for the energy and enterprise there displayed.



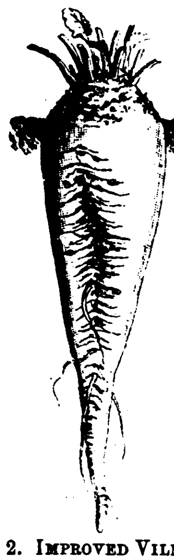


Fig. 1. Bad Shape. Fig. 2. Improved Vilmorin.
White Sugar Grayish Top.

Fig. 3. Good Shape.
Improved Duprez.

WHAT THE BEST SUGAR BEETS LOOK LIKE.

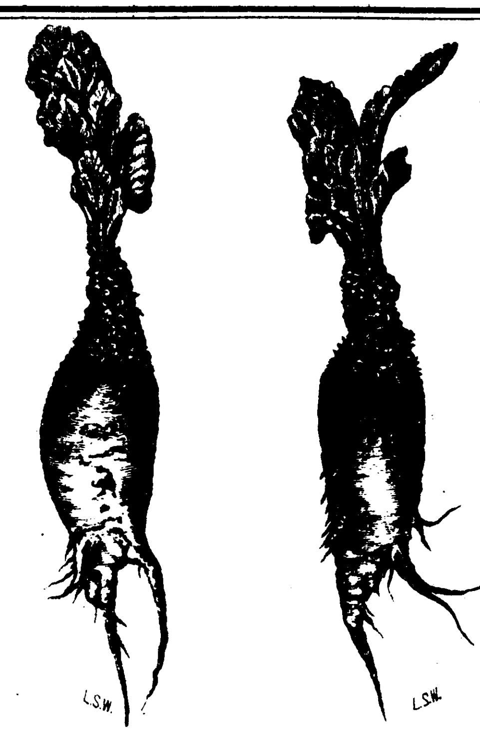
When we experimented throughout the country with various varieties of *sugar-beet* seed, with the view to ascertaining the soils best adapted for their cultivation, we were thoroughly convinced that but few farmers had even a slight idea of *what the sugar beet looks like*. Some, when asked if they had grown these roots, replied that they had, but that they would not continue to do so, as these had not proved to be profitable crops, either in the market or when used for feeding domestic stock; and that they were convinced that the carrot and other roots came nearer to what was required than did the beet. When these gentlemen entered into the details concerning the size, general external appearance, manner of growing, etc., their ignorance of the subject became more and more apparent. For example, in New Jersey we were told that these roots grew some eighteen inches in length, frequently with a diameter of eleven inches; that twenty pounds for their weight was not uncommon; that they grew about one-half above ground; that their flesh was watery, and that hollowness was general. Upon investigation we found that their so-called "sugar beet" was the mangel wurtzel,* or that frequently the ruta-baga† had passed for what it was not. When these farmers were informed that the sugar beet (unlike the mangel wurtzel) grew well underground, that the neck alone was visible, that the diameter of the roots was small, that the color of the skin was nearly white, and that the weight rarely exceeded two pounds, they became convinced that they did not even know *what the sugar beet looked like*. When the beets from our seed were ready to be taken up, we remained upon the field to ascertain by the farmers' actions if the sugar beet had been actually before planted. Their amazement on seeing roots of this kind was beyond description; and they acknowledged that then the sugar beet had, for the first time, been grown in their section of the country. Some few roots were fed to their cattle, and they acknowledged the resulting beneficial and fattening effects.

When farmers or those interested in the sugar-beet culture buy seed with the view of testing their soil, it is desirable to know if this was, *when bought*, of the best variety. This cannot be actually ascertained in advance, as the crops alone will be proof

* "Mangel Wurtzel" is derived from the German, and means scarcity-root; while, on the contrary, it is most abundant. These roots were first known in Germany, and were brought to France by Dr. Lytson.

† This is a Swedish turnip, and contains seldom over two per cent. of sugar.

UNSTRIPPED.



EVIL RESULTS OF STRIPPING.

THE LEAVES OF THE SUGAR PLANT.

that no deception existed; for that reason it is desirable to know *what the best sugar beets look like.*

In order that our readers may appreciate the external difference, we give an illustration (Fig. 1) of a "*white sugar grayish top.*" This variety closely resembles the mangel wurtzel in its manner of growing; but the skin, instead of being reddish, like the latter, is white, and the neck far less conical. Its maximum yield to the acre is 96,000 pounds and it contains only about 6½ per cent. of sugar. Even this type is preferable to the mangel, as it contains a far greater percentage of sugar, and is susceptible of improvement.

We shall now consider two of the best types. First, we may mention the *Improved Vilmorin* with small neck. The shape, as shown in Fig. 2, is conical. It grows entirely beneath the surface; has an average weight of about one pound and is said to contain about fifteen per cent. of sugar. The maximum yield per acre is 28,000 pounds. Mr. Vilmorin's beet attained this state of perfection in 1879; but since then we have planted it, and we regret to say that it has shown a tendency to become forked, thus rendering the harvesting difficult; but its shape as represented in the illustration is most satisfactory.

If we now examine the types of sugar-beets that have taken recent prizes at the agricultural exhibitions throughout Europe, we will find long roots with comparatively small diameters (see Fig. 3.) These are the result of Professor Violette's selection of mothers and of improved methods of cultivation. These are known in Europe as *Deprez No.* 1. These roots have frequently contained seventeen per cent. of sugar, and have an average yield of 24,000 pounds to the acre. In the illustration we have supposed a theoretical shape for the neck, and, as shown, this is small and conical, and grows partly aboveground. The yield in this case, when compared with that of the grayish top, is small, but the percentage of sugar is double, and these very saccharine qualities are what is wanted. Admitting that these roots contained proportional quantities of other elements than sugar, the amount to be worked up would be double in the grayish tops that in the Deprez, while the amount of sugar that could be extracted would be the same. Consequently we have double the expense for the same result; and other complex manufacturing difficulties arise when using the large beets.

Let it be remembered that beets which have the appearance of figures 2 or 3 will, as a general thing, contain a satisfactory amount of sugar, and when it is asked *what the best sugar beets look like* these shapes should be borne in mind. In conclusion we would say that farmers should not be misled by large crops and large roots, as the one is consistent with the other, but not with the sugar these roots are expected to yield.

THE LEAVES OF THE SUGAR BEET.

While the leaves grow the root increases but little. After the leaves cease growing, the root rapidly becomes larger.

Small leaves, with given signs indicate roots rich in sugar.

Lime soils produce small leaves, for reasons unknown. Stripping the leaves makes the necks longer, increases the water, and lessens the sugar per centage in the root. The explanation of the latter is that the neck contains the greatest amount of salts and the least sugar.

Beet Sugar Product.—The continen of Eu rope now pro duces from beets more than one-fourth of all the sugar of all kinds made in all parts of the world. France makes 451,000 tons; Germany, 290,000; Austria, 205,000; Russia, 150,000; Belgium, 80,000; Holland and Sweden, 35,000—in all, 1,211,-000 tons. France has about 500 sugar factories, and about as many distilleries for beet spirits and for beet sugar molasses. In this country capitalists are awakening to the importance of this branch of manufacture, and already immense establishments have been organized in some of the Eastern States. The prairies of the West afford the finest field for the cheap production of the beet.

Grapevine Leaves as Hops.—Did any reader ever try using grapevine leaves instead of hops in bread-making? Simply use grape leaves as though they were hops, only, perhaps, requiring a little larger quantity. After having made yeast, just before setting it to rise, stir into it from one-half to one tea-spoonful (according to quantity of yeast) of light hop yeast, or that made by soaking yeast-cake in a little warm water, stirring in the flour and allowing it to rise. After the yeast has become light, use as you would hop yeast. While the leaves on the vines are still fresh and green, gather the tenderest and best, dry and save for winter use.—*Inter-Ocean.*

The largest sheet of plate glass in the world has recently been cut at the St. Gobain works in France. It measures 21.15 ft. by 13.48. It is 7-16 of an inch thick. It is white glass and weighs 1,573 lbs. The same works have turned out a silvered mirror 17.90 by 9.94 ft., weighing 770 lbs. The Jeumont works have produced a plate of white glass 17.81 by 11.51 ft., which weighs 1,100 pounds.

Sanitary Matters.

HOUSE DRAINAGE.—I.

The Sanitary Committee of the Society of Arts (London) were able to obtain evidence from Messrs. W. Eassie, Rogers Field, and E. F. Griffith (three engineers having wide experience) on various matters connected with house drainage. The following is the part relating to the examinations of houses and to works:

MR. WILLIAM EASSIE:

Will you be so good as to describe, as practically as you can, what is the course of your examination in diagnosing, so to speak, the condition of the house?=In the "Practical Hygiene" of Drs. Parkes and De Chaumont, I have furnished a description of how this is usually carried out in ordinary cases. I first begin with the drains, which I lay bare when I can do so, at various places, in order to see of what they are composed. When I find that they run inside the house, and are not concreted around, I pour in at the end of the drain a measured quantity of water, and collect it at the opening made somewhere in the area, not far from the outfall into the sewer. In some cases I find it necessary to fill the drain with water, and notice if this water disappears, because if it does so, it betokens unsound pipes or bad jointing, in which case I take it up and relay the drain. In testing the suitability of a drain for properly conveying away solid matters, I work the closet by pouring into it some suitable substance, and watch at the opening in the area whether it speedily appears. If it does not quickly made its appearance, and especially if the scouring dislodges any excess of paper or solids not introduced by me during the testing, I conclude that the drain is not calculated to retain improperly the voidance, and I then recommend the drain to be taken up and relaid. By these means I am able to ascertain the general soundness of the pipes, their freedom from forming deposits, and their velocity of flow. If the house has been rebuilt upon an old site, I also examine for any old cesspools or brick drains. I next ascertain the absence, presence or condition of the main trap between the house and the sewer, which is generally found in one of the area vaults. If it is a dis-trap, I invariably find it acting as a cesspool, and remove it, and I do the same with some patterns of syphon traps. Where I am permitted, I then construct a disconnection chamber, with a fresh-air inlet of some kind suitable for the place; and as the next thing to consider is the ventilating outlet of the drain, I pay particular attention to the absence or presence of the ventilating pipes. If the soil-pipes be adequately ventilated, and if these are at the extremity of the drain, carried up to the roof, and terminating sufficiently far from windows and chimneys, I consider them calculated for the work which they have to perform in the matter of ventilation. But I sometimes introduce special ventilating pipes. When the soil-pipes descend into the house, I fill them with water in order to ascertain their soundness; and if, as I frequently find, they leak, I recommend them to be taken away and others fixed, if it be at all possible, outside the house. I always assume the soil-pipes to be faulty, owing to improper jointing or decayed solder seams, and subject them to the water or some other test. An examination of the closets follows, and if they are of the horrible pan pattern I condemn them, and if of the valve pattern, with D-traps I remove the latter. Of course the woodwork around the closets must be taken round, and if the trays or safes have their wastes conducted into the D-traps, I make a note of the removal. I pay particular attention to the servants' closets, and see whether they flush properly and are of a good pattern. The next inquiry is regarding the cisterns which supply the closets, and it frequently takes a considerable time to ascertain whether these cisterns also supply drinking water, and to where the overflows are led. If I find them supplying taps from whence drinking water is likely to be drawn, I proceed to notice where a separate cistern can be fixed for this service, and make a memorandum of recommendation to this effect. An examination of all other cisterns follows, and I carefully notice whether the overflows are properly disconnected, and also the physical appearance of the water and the state of the cistern interiors. I notice whether any of the basement closets are supplied direct from the mains. Very likely next in rotation would come the waste deliveries of the sinks, baths, and lavatories. If, as I too frequently find, they enter the soil-pipe, the closet-trap, or the drain direct, I specify their immediate removal. It is sometimes difficult to disconnect some of the sinks in the interior of the house, but it is always possible to contrive some method of doing so. I always make a note insisting upon the disconnection of the rain-water pipes, and their delivery over a gully. When I find an improper disconnection as is frequently the case with sink wastes, I indicate the best method. Sometimes a too free method of disconnection has been followed, as, for instance, where an untrapped sink waste is made to deliver close to the trapping water of a gully, and where the effluvium from the latter is led into the room. I find it very often necessary to draw attention to the position occupied by the closets, and to the want of ventilation of the spaces in which they are placed, as also to the general ventilating arrangements of the house, and whether there is a proper air flushing, it possible, to the rooms and staircase.

What forms, sizes, and inclinations do you usually adopt for house-drains? My chief desire is to make use of the smallest possible pipes, and I use stoneware pipes of four inches diameter when these can perform the work, and if they will not, then pipes of six inches diameter. Sometimes I am obliged to use pipes nine inches diameter, but this is more rarely, and only as a main when several six-inch pipes junction into it. I rarely find use for twelve-inch pipes. The fall greatly depends upon the depth of the sewer, and I take as much fall as the latter will afford me, providing a little extra fall before the main disconnection chamber. Where there is a good means of flushing, the amount of fall is of less consequence. I find houses where it is impossible to get a fall of more than an inch in ten feet. Mr. Field's self-acting syphon is of immense advantage in such cases, and I have fixed them in connection with the sinks whence the cleaner kinds of wastes are delivered.

What are the modes you find applicable for testing the sufficiency or competence of this description of work?—If the pipes are laid down on proper lines, surrounded by concrete, with occasional man-holes it is very easy to ascertain whether they act properly. As for the disconnected traps, their efficiency can be seen at a glance. The chief delinquencies are found at the water-closets, and the proper working of these is tested by the rapidity with which introduced paper, etc., can be carried to the disconnection chamber, which I mostly cover for this very purpose with an iron man-hole cover easily lifted up. If any smell arises in a properly laid drain, and from a closet, the soil-pipe of which is ventilated by a pipe of the same diameter, to the outer air, I generally attribute it to some temporary stoppage of the drain, owing to the introduction of some foreign substance, such as a duster down the closet. In any case the fault ought to be easily remedied when the work has been properly executed. In every case where pipes are led down inside the house, they should be cased in with hinged casings, and the seats and risers of water closets should also be so constructed as readily to afford inspection. It is not in my opinion necessary to employ a workman to test the efficiency of any drain, and as I provide a plan of the house, showing the position of the man-holes and air-chamber, it is only necessary for a servant to raise the covers to see if the drains run clear. Screw caps on the various traps render it easy to remove any temporary stoppage at these places. With a proper plan of the drain in his hand, and with an air-chamber, *i.e.*, a disconnection chamber, easy of access, a man should be able to test the efficiency of all the waste removals, in the course of an hour, even in the largest houses.

MR. ROGERS FIELD:

Will you be so good as to describe, as practically as you can, what is the course of your examination in diagnosing, so to speak, the condition of a house?—The first point is to ascertain whether the drains pass underneath the house or outside it. If they pass underneath the house I test them carefully for soundness (to ascertain whether they are water-tight), as well as testing them for freedom from deposit and velocity of flow. If they pass outside I merely apply the two latter tests. The test for soundness is managed as follows: The drain is opened down too, at its lower end generally in the area between the house and the street, and carefully stopped with a plug of clay. Another opening is made in the drain, and the drain is then gradually filled with water. As soon as the drain is full the water is turned off, and carefully watched at the upper opening. If the water remains in the drain, the drain is sound, but if not, the drain is leaky, and the rapidity with which the water sinks indicates the amount of the leakage of the drain. It is not at all unusual for the water to run away so rapidly that it is impossible even to fill the drain so as to make the water show at the upper opening at all. The test for deposit is by flushing from the closets, sinks, etc., and pouring down a large quantity of water and watching the drain at the opening at the lower end (of course without any plug in it). If the water comes down thick or with a bad smell, it shows that there is a deposit; if it runs clear and sweet, it shows that the drain is clear. The test for velocity of flow is by noticing the time that water takes to run a given distance. Whether there are any old drains or cess-pools, can only be ascertained by opening up and searching for them, and this must be done whenever there is any reason to suspect their existence. The next point is to ascertain whether there is any trap between the house-drains and the sewer is generally unmistakable evidence of the absence of the trap. Should there be a trap, it must be opened down too, as the chances are that it is so constructed as to be more or less full of deposit. It must, of course, also be ascertained whether the drains are ventilated. There is not much difficulty about this, as it is generally evident they are not. The next proceeding is to examine and test all the details of the sanitary arrangements, water-closets, sinks, baths, etc., and as it would take much too long to describe all these various necessary operations, I must simply refer to a few of the most important points. The soil-pipes must be carefully examined, and if they are inside the house they must be specially tested. If of iron, with putty joints, as is often the case, they may, without much risk of error, be assumed to be unsound; but if it is wished to test them, this could be done by the smoke test. If they are of lead, they should be tested by being plugged and filled with water. A glance at the water-closet apparatus is enough for an experienced man; but it is necessary to take down the seats to see whether the overflow of the "safes" or lead trays underneath are connected with the soil-pipes, as is often improperly the case. The condition of the traps can be tested by lifting the handle of the closet and noticing whether any smell comes up (in a good closet no smell is perceptible). If, however, the apparatus is of a faulty description, the closet is sure to smell sooner or later. It must be carefully ascertained what cisterns supply the closets, and, if there is the least uncertainty, the cisterns must all be tested by drawing off water from them, and in some cases by coloring the water. The waste-pipes of sinks, baths, etc., often give a good deal of trouble. A good way to trace them is by pouring down hot water, and feeling which pipe becomes heated. If hot water poured down the waste of a bath, for instance, heats a soil-pipe, it shows that the waste of the bath goes into the soil-pipe. It is never safe to trust to appearances, as the following curious instance will show: In a house I recently examined, I saw an open end of a pipe projecting through a wall, and was informed that it was the overflow of the cistern. I tested this overflow by pouring water down it, but no water came out of the projecting pipe. I was then told that it was the wastes from the "safe" or tray under the water-closet I tested this in the same way, but no water came out of the projecting pipe. I was then told it was the waste from the safe of a bath, and on closer examination I found that the pipe evidently did come from the bath. I thought it better, however, to test it by pouring water into the safe of the bath, when to my surprise no water came out of the pipe. I then had the casing of the bath taken down, when it was found that the pipe had surely enough been connected with the safe of the bath, but at its highest point, so that no water would run out of it, and that the real outlet from the safe of the bath was into the soil-pipe. The explanation was, no doubt, as follows:—The outlet of the safe had always gone into the soil-pipe, but some former tenant had insisted on its being altered. To do this properly, the fall of the safe must have been altered, which would have involved some expense, and the projecting pipe had therefore been run through the wall as a sham to deceive him. The bath in question was in a dressing-room opening into a bedroom, so that the connection of the outlet with the soil-pipe was a very serious matter.

How long does the process of examination usually take?—The time varies so much with the size of the house, the complication of the sanitary arrangements, whether there is any plan or not, and the facility of examination, that it is almost impossible to answer this question. In order, however, to give some rough idea, I may say that in an ordinary London house of moderate-size the examination would probably take from three to four hours of my personal time. This is on the assumption that the house had been previously prepared for my inspection by having the concealed parts exposed, and that no great amount of testing is required. If the sanitary arrangements are complicated, or if there is delay on account of workmen opening down to the drains, making preparations for testing, etc., the time is largely increased. In very many cases, however, after opening down to the drains, I consider it unnecessary to test them, as I am morally certain that they are leaky, from my experience in testing other similar drains.

What forms, sizes, and inclinations do you usually adopt for house-drains?—I generally use stoneware pipes of 4 or 6 inches diameter. Occasionally 9-inch pipes may be required in very large houses, but this is only under exceptional circumstances. Under ordinary circumstances 9-inch pipes are too large even for considerable sized houses, and it is a mistake to use them. The fall varies immensely according to circumstances, but I always endeavour to obtain a fall of 1 in 30, or 1 in 40, for ordinary house-drains. When, however, self-acting, flushing arrangements are employed, the fall may be greatly reduced, and I have 6-inch main drains carrying the sewer from large mansions working very satisfactorily with falls of 1 in 100 to 1 in 200, where flushed by my self-acting syphon.

What are the modes you find applicable for testing the sufficiency or competence of this kind of work?—In order to render my answer intelligible, I must, in the first place, explain that the different portions of all sanitary work carried out by me are made as accessible as possible. The drains are laid in straight line, with man-holes, or inspection openings, at every change of direction. The traps on the drains are made easily accessible. The soil and waste-pipes are never built into the wall, and, if cased, the casings are easily removable. The open ends of all waste and overflow pipes are made visible. The water-closet seats are all hinged, so as to lift. The traps of sinks, lavatories, etc., have screw-caps for inspection and cleaning. It is then a comparatively easy matter to examine and test the drainage. The drains are tested to see that they are water-tight when they are laid, but this test (by blocking and filling them with water) can be applied at any time. The accuracy of the laying of the drains, and their self-cleansing capacity, can be immediately tested by trying the velocity of flow, as already explained. The traps on the drains can be tested by examining whether any solid matter rests in them, and also by trying whether paper, etc., flushed down the drains passes through them. The sufficiency of the flush of the water-closets can be tested by seeing whether it drives paper through the traps. The test of smell is also valuable, as in well-laid drains any other smell than that of fresh sewage is an indication that something is wrong. I may add that in the work I carry out, I not only supply my clients with an accurate plan of the drains showing every detail, but also a detailed schedule referring to the plan, giving particulars of every pipe, trap, closet, man-hole, inspection cap, etc., with a written description of the works, and detailed instructions for keeping them in order. This is extremely useful for future references, and in some cases my clients have duplicate copies made, and deposit one of them with title-deeds.

HOUSE DRAINAGE WITHIN THE WALLS.*

These demand still more care and skill than the drains outside. In the latter case the soil has certain absorbent powers, combining chemically with the products of decomposing filth, or holding air in its pores for the oxidation of the noxious compounds, which are thus rendered innocuous. Moreover, the poisonous influences within the walls are more likely to be absorbed by and act upon our systems through the lungs than if out of doors, and diluted more or less by air being admitted into the houses of those who cannot afford to heat it during six months of the year. The suffering from frost is immediate, leading the poor man to calk up every crack, while the injury from bad air is a slow poison, warning us only by the sense of smell, a sense which soon becomes benumbed, and rarely becomes sufficiently imperative to lead to action. In fact, its importance is not appreciated by a large part of our population. They might perish with the cold if they let in the air, so they choose the chance of living without it. We must therefore expect bad ventilation among the poorer classes in cold weather. The volatile exhalations of the skin and lungs are not always so easy to get rid of as the fluid and solid excreta. But in getting rid of the latter, if we do not take great care, they too become gaseous, and return to plague us in the air already heavy with the exhalations of the lungs and skin.

The introduction of water-closets in tenement-houses should therefore be guarded with special attention, or the benefits to be derived from their use will be more than cancelled by the evils which may arise from their defective construction.

It must be remembered that houses situated on high places, though enjoying the advantage of good opportunity for drainage, may be more exposed than lower sites to the invasion of bad gases from drains and sewers, for the very reason that they are higher, for these gases are light, and are always tending upward. It is well known that the pressure in our gas-mains increases very perceptibly as we rise a hill, being about double the ordinary working pressure at an elevation of two hundred and

* A lecture by Mr. Edward S. Philbrick, C.E., delivered before the students of Technology.

eighty feet above the works, and although the gases in our sewers may not be so light as illuminating gas,* they are somewhat lighter than ordinary air, and are therefore always tending upward by their buoyancy. This tendency is aggravated during the winter by the rarefied condition of the air within our houses, the ordinary heating of which always creates a slight inward pressure from the outside in all the lower stories.

As a general rule, it is, of course, advisable to limit the length of the drains within the house walls to a minimum, for the reason that a large number of joints increases the risk of leakage. In planning the lines and course of drains, therefore, this should be kept in view.

In planning the general arrangement of plumbing fixtures, care should always be taken to have them arranged as *compactly* as consistent with convenience, and to avoid scattering them about in remote parts of the house, from which the drain pipes can rarely be collected and combined with a proper fall to guard against deposits being formed in them. It is also a matter of no small importance to place the drain and waste pipes so they can be readily accessible for inspection and repairs, without tearing up floors. When located under basement floors, loose trap-doors should be left for access, and if the drain is necessarily below the surface of the ground it should not be buried, but walled in on each side by brick.

The material for drains within the houses should be of metal, in all cases. Stone-ware pipe cannot be trusted on account of their fragile and porons joints, through which gas can penetrate, though they may be impervious to water. For all main-drains and soil-pipes, cast-iron is the best material. It is made in lengths of six feet, with all the necessary special forms for joints, bends, etc. Its joints should be filled with melted lead, and well calked. Right-angled connections must be avcided, except in vertical pipes, for the same reason as has been given for outside drains. Oblique connections can always be provided for by arranging the lines of pipe for the purpose, if care be taken. Vertical lines of drain from water-closets, generally called soil-pipes, were formerly made of lead, and this material is still used in England. But iron has taken its place in this country for several years, with success. It has these advantages: Its rigid nature renders it less likely to get out of place than lead, which often sags and changes form. Lead is also more subject to corrosien from the gases existing in drains than cast-iron. Wrought-iron would rust away rapidly, but cast-iron rusts only on the surface, and seems capable of enduring for twenty years or more, while lead is often found badly corroded in ten years. The corrosion in lead takes place along the joints where in contact with the solder, probably from galvanic action, excited by the contact of the two metals. Lead is often exposed to damage, as is shown by these samples before us, taken from houses in this city, also from rats, which gnaw holes in it, and nails carelessly driven in securing the wood-work have often made holes that were not discovered for several years. The joints of iron pipe are sometimes put together with putty by poor workmen, but it can never be relied upon for any length of time. It soon crumbles away and becomes worthless. The lead should be applied nearly or quite at a red heat, so as to penetrate the thinnest parts of a joint without becoming chilled. When cooling, it contracts so much that it must be upset with calking tools, applied around the whole circumference.

The small waste-pipes from bath-tubs, bowls, sinks, etc., are generally made of lead, which is a very suitable material. Where entering the iron pipes, the joint is often made by applying hydraulic cement, putty, or red lead. But the proper way is to solder a brass ferrule to the lead pipe, which is inserted into the bell of the iron pipe. This gives a stiff material, against which a lead joint can be calked, in the same way as between two pieces of iron pipe. When lead traps are used under water-closets, the joint between these and the iron soil-pipes should be secured in the same way.

Every vertical line or "stack" of soil-pipe should extend through the roof of the house at least four inches in diameter, and far enough above the roof to ensure its end from being filled with snow. The end should be left wide open. If a smaller pipe than one four inches in diameter be used, the part projecting above the house roof will be liable to be filled with hoar frost on cold nights in our climate. With this arrangement a constant draught is maintained through the house drains, entering at the vent-hole close to the outer trap, and passing up through the roof of the house. The temperature of the house in winter is always enough above that of the outer air to sustain this draught. In summer the sunshine on the upper end of the pipe will encourage it, for the hole at the lower end is below the surface, where the ground cools the air and thus renders it slightly more dense. This upward draught is reversed for a moment whenever a considerable charge of water is emptied into the drains from the upper stories of the house, for the water pushes the air down as it falls, and other air takes its place from the upper end of the pipe. If both of these holes are not kept open, trouble will be sure to follow the use of the drains, for the water rushes down the vertical like a piston, to drive all the air in advance. If the free escape of this air were not provided for by the vent-hole at the bottom, the air within the pipe would be forced out at any or all the branch drain-pipes in the lower story, forcing their traps and blowing their contents up through the waste-holes in a very disagreeable manner. The puff of air that is thus driven out of the house-drain at its lower vent-hole by a descending charge of water from the upper stories, has sometimes been objected to on the ground of a possible offence arising from it at the mouth of the man-hole over the trap previously described, but this is not found to exist in practice. The air from a well-ventilated drain is not so foul as to pollute the air outside the house to any great extent, though when allowed to escape and taint the air *within* the walls, where the dilution is very much less, the result is much more serious. Moreover, as before explained, the escape of air at this lower vent is only by occasional puffs forced out by descending charges of water, while at all other times the draught is inward at the lower vent-hole. So that this very air which may have been forced out for a moment into the man-h le chamber, is again drawn up through the pipe and delivered at the top of the house above the roof, before it has an opportunity to escape from the top of the man-hole itself. Practically, no reason appears to exist why these vents should not be placed near the house, outside, in either the front yards, on the sidewalk, or in the back yard, as the case may be. If the man-hole cover is liable to be covered with snow for any depth, an air pipe of four or five inches should be fed up from beneath the cover, to terminate a few feet above the ground at the top of a back yard fence, or similar position.

The arrang ment described above is essential to every house. By this means every part of the main drain is not only kept in accord with the normal atmospheric pressure, but is also swept by a constant current of air. If there be more than one stack or vertical line of soil-pipes, each one should extend through the roof separately.

Smaller branch waste pipes leading from bowls, bath-tubs, sinks, etc., can all connect or discharge into the soil-pipe or main drain where most convenient, but each branch should also have a vent to the open air, and a separate trap under each sink, or bowl. Without such ventilation for each branch, the discharge of a few gallons of water through any of them will be likely to empty any or all the traps that connect with it, by syphon action. Moreover, the discharge of water down the vertical stack itself will often produce this effect, by the friction between the descending water and the air in the branch pipe at the junction. It is always best to lead the waste from each bowl, or tub *separately* to the soil-pipe or drain. If these branches connect with one another before joining the soil-pipe, the drainage through one is very likely to disturb the air in the other, and thereby destroy the seal in their traps. It has been a common practice among plumbers in this country to lead the waste water from bath-tubs, bowls, etc., into the trap of the nearest water-closet, below the water line; but such a practice is never advisable, for several reasons. The discharge of warm water into this large trap heats up its contents, which are generally composed in part of fecal matter, and the steam and odors arising therefrom are very likely, by their expansion, when so heated, to find some crack by which they can penetrate into the room. Moreover, a slight sagging of one of the pipes or a tipping of the trap itself, which sometimes occurs in time, will throw the connection above the water line and destroy the seal. Another defect in this method of connecting wastes of bowls to water-closet traps arises from the length of waste under the floor which has so little fall that the trap water holds the water back in it for several

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* Ordinary illuminating gas has a specific gravity of .42, that of air being 1.00. The increase of pressure in gas-pipes as they extend up to a higher level, is due to the difference in weight between the air and gas for the height traversed: gas when distributed from the works is under a pressure of about 2½ inches of water.

The weight of a cubic foot of water is 62.4 lbs.
" " " " of air is 0.08 lbs.
" " " " of gas is 0.0336 lbs.

Difference between air and gas equals 0.0464 lbs. per cubic foot.

We have then the following proportion:—

.0464 : 62.4 : : 1 : 1335 inches, or 111 feet elevation for one additional inch of water pressure.

feet, where it has ample time to make noxious deposits. (See Fig. 2.)

It is usual to provide a small tank or cistern in the upper part of a house, from which water can be drawn, when wanted, more rapidly than from the small pipe which supplies the house from the street. Such a tank is fed by a faucet governed by a float, so that it is kept nearly full. As any defect in the action of the float might cause the tank to overflow, it must always be provided with an overflow pipe, to carry off the water in such an emergency. If this overflow-pipe is connected to a waste or drain-pipe, the foul air will rise through it and escape through its open mouth at the top, where it may taint the water by being absorbed by it, or taint the air about it. No trap placed upon such an overflow can be relied upon, for the flow occurs so seldom that such a trap would lose its water by evaporation and soon becomes worthless. The safer way is to discharge such overflow pipes in the open air, either outside the house, in a rain-spout, or on the roof. If this cannot be conveniently arranged, they should be allowed to discharge over an open sink or bath-tub, or similar receptacle, without direct connection with the drains. Where no public water supply exists, large tanks for storage of rain-water are sometimes constructed as a source for domestic supply, located under the ground, which overflows discharging into the main-drain. Such a course should never be allowed. No intervening trap can serve for stopping the back flow of gas, because the overflow does not occur often enough in dry weather to ensure the presence of water in such traps. Such overflows ought to be discharged on the surface of the ground, or in a pit filled with loose stones in a porous soil, where the water will readily soak away at all times. An instance occurred within my own observation a few years ago, where the overflow of a rain-water tank discharged into the main drain. This became choked with grease, and sent back all the sewage of the house into the cistern, through the overflow. The water was used for all domestic purposes, and its pollution was discovered only through the nauseous taste it had acquired after some week's accumulation of sewage in the cistern. This leads us to the question of grease in drains, a prolific source of annoyance in our climate. The grease comes from the washing of dishes in kitchen sinks, which goes down the wastes mixed with warm water in a fluid state. It soon becomes chilled in cool weather, and adheres to the sides of the drain, where it accumulates continually, till sometimes filling the pipes for long distances. If the drain has a very rapid descent, the flow of water may sometimes prevent this accumulation, but otherwise some provision is needed for intercepting the grease in a small tank. The nearer this tank is to the sink the better, to guard against the choking of the pipe above the tank. Where the sinks are located against the outer wall of the house, the tank is best placed outside the walls, where the grease can be removed without creating a nuisance in the house. Such a tank is shown in this section (Fig. 3), built of brick and hydraulic cement, plastered smoothly inside. For small and medium houses it should be at least three feet long on the inside, and about two feet wide, with rounded corners. The outlet should be made of a bent joint of pipe dipping under the water, so that the grease, while floating on the surface, will not be drawn into it. The inlet should be at least six inches higher than the outlet, so as not to be obstructed by the accumulation of grease which takes place in the form of a thick scum on the water. It is also best to allow about a foot below the mouth of the outlet in the clear, for accumulation of sand and other solid matter which is heavier than the water. A man-hole cover is placed on the top; through which the grease may be removed as occasion may require. The soil-pipes from water-closets should never discharge into this receptacle. It should be arranged upon the branch leading from the kitchen and pantry sinks only, having its outlet connected with the main drain when convenient. If the sink is not situated near enough to the outside of the house to allow this grease tank to be constructed outside the walls, it can be made in the cellar or basement, of wood, and lined with heavy lead. In such cases, the grease does not cool so readily as on the outside, and if the tank is not of a liberal size, the grease is liable to pass through before being separated from the water. Whenever drains become choked with grease, if the pipe is accessible, it can be cleared by pouring hot water over the outside in a small stream, for half an hour or less. This heats up the whole contents, and the softened grease then passes along with the water that is applied inside. But the better way is to catch the grease before it gets into the pipes. If once allowed to coat the inner walls of the drains, much trouble will ensue.

I have before alluded to the need of getting the plumbing fixtures inside the house arranged as far as possible in compact groups. It is a very common fault among architects to so arrange them that their drain-pipes are led across considerable lengths of floor spaces, with little or no fall, terminating, as before described, in a water-closet trap, just below the floor, which sometimes holds the water for several feet back in this horizontal reach of pipe. (See Fig. 2 above). Whenever a bowl-full of water is discharged into such a flat waste, the lower end of which is filled with water, the air that happens to be in the pipe above such water is displaced and is driven out. Where can it escape? Sometimes it finds a branch waste coming in from another apartment, and is blown up that, through the trap and waste-hole of a wash-bowl in a sleeping-room or dressing-room attached. Sometimes it bubbles up in one's face in the bowl that is discharged. Sometimes it is pushed forward and bubbles up in the water-closet. The result in either case is far from satisfactory, and shows how important it is to give each line of waste an independent and unobstructed course to the main drain or soil-pipe, where the air can find ready communication with the outer air.

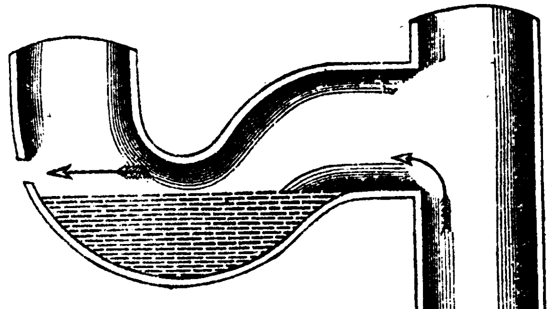


Fig. 1.

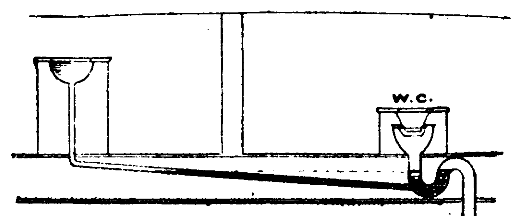


Fig. 2.

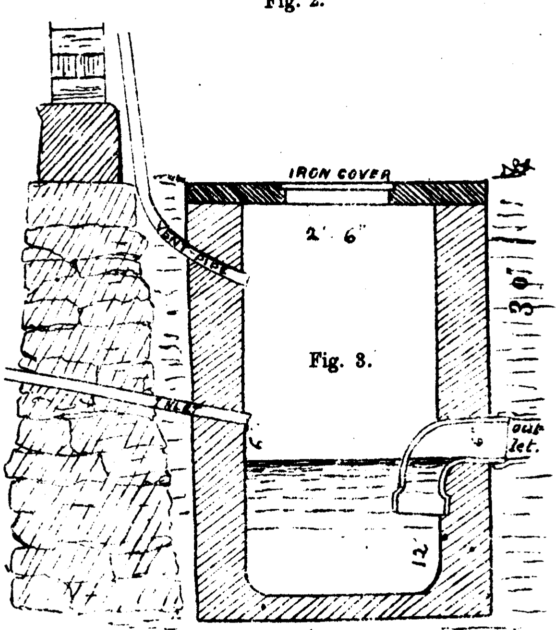


Fig. 3.

EFFECT OF STARVATION ON THE BLOOD.

Further observations upon the gradual improvements of Dr. Tanner's blood have made it necessary to modify the statements made at the close of the article on this subject in the last number of the *Scientific American* (see page 128). It was noticed that the quality of the blood varied greatly in different specimens obtained from day to day, and even in specimens drawn the same evening. It was at last found that if the blood was drawn from a very small puncture, from which it had to be pressed out forcibly, it was found to be in a much worse condition than if drawn from a deeper puncture from which it flowed freely. It is evident that in the first case it was drawn only from the capillaries, and in the second case from the larger vessels, in which a regular circulation takes place. This appears to prove that the abnormal corpuscles linger in the capillaries, and that it takes time to remove them therefrom, while in the larger vessels, in which free circulation takes place, restoration may already have been accomplished to a considerable extent. Close observation appeared to show that this restoration was taking place in two ways, by a cleaning and healing process of the affected corpuscles, and by the formation of new ones. The first was proved by the observation of corpuscles in all stages of the healing process from the most abnormal to the perfect smooth ones. Some of those which had become free of fungoid spores appeared, however, to have suffered considerably, some were partially destroyed, some were only half or parts of perfect corpuscles, and no doubt such will be either eliminated from the system or the defective parts healed up. Which of these takes place is a question. The second process of restoration was proved by the appearance of fresh and small corpuscles, looking very smooth and perfect, and bearing the stamp of youthfulness upon their appearance—we would almost say countenance—a freshness which became more striking the higher the magnifying powers were by which they were observed, in comparison with the affected corpuscles, in which the higher powers showed the imperfections more strongly.

This corroborates what other microscopists have observed in regard to the formation of new young blood corpuscles. It has, however, been denied by others who failed to observe it; but this is merely negative testimony, of which there appears to be a great deal in the medical profession; it proceeds from a kind of conservatism, which lies at the basis of all the medical intolerance manifested by the so-called regular school against all supposed innovations, even among their own brotherhood.

A striking illustration was offered in this regard by the discovery of Prof. Cohnheim, of Kiel, who found that pus globules could originate from the white blood corpuscles, but whose observations were most strenuously opposed at first by the majority of the profession, who could not see it. It may be mentioned here, as it has some relation to Dr. Tanner's fast, by which fast the number of his white blood corpuscles was more than quadrupled. It is well known that persons subject to privation of food have a strong tendency to pus formation and running sores, and if starvation increases the number of white corpuscles, these combined facts appear to support Cohnheim's theory. The opposition against it was, however, set at rest by Dr. Bastian, in London, and Surgeon Woodward, U. S. Army in Washington, who verified Cohnheim's observation, and by Huxley, who adopted it in his great lecture on protoplasm.

The number of white corpuscles did rapidly diminish after the fast in Dr. Tanner's blood, and was soon reduced to the normal proportion; but the interesting change in the red corpuscles and their very gradual restoration during a length of time, is a contribution to science which Dr. Tanner has given after the end of his fast, and this should be acknowledged.

WHAT CONSTITUTES AN ILLEGAL STRIKE.

Judge Cady, of St. Louis, has just given a decision of considerable importance in respect of the rights and duties of striking workmen. The case was that of the Vulcan Steel Works of St. Louis against eight of its workmen in the converting department, who stopped work and demanded advanced wages at a moment when two charges were melted and partly melted in the cupola, a charge of metal in the scale ladle, and the pit filled with ingots in the moulds. The evident intent of the strikers was to take advantage of this condition to force the works to yield to their demands. The counsel for the defendants claimed that they were guilty of no crime, either under statute or common law, and moved to quash the indictment. The Judge held otherwise and held them for trial. The important part of the decision is, that while it may be no crime to conspire or agree to stop work unless higher wages are paid, it is a crime to thus conspire or agree under circumstances which menaces the employer with serious loss. The tendency of the decisions of our courts on labor questions that have been brought before them lately, is all in this direction, and a body of decisions that will be valuable as defining the rights and limitation of unions and strikers is being accumulated. These decisions take the ground that unions and strikes are not unlawful in themselves, but that the acts of unions and the circumstances under which strikes occur may be criminal, and thus the union itself or the strike may be clearly illegal, and make those who are members or who take part in it liable, both in civil and criminal suits. This was the position taken by the Judge in the Zanesville (Ohio) case. He held that certain of the rules of the Glass Blowers' Union were so clearly against public policy, and so evidently constituted a conspiracy against those not members, that he immediately threw the union out of court, and stated most decidedly that its members were liable to prosecution. In the St. Louis case a rule will probably be laid down showing some circumstances under which a strike may not take place without subjecting the strikers to criminal prosecution. It is evident that some rule must be adopted that will prevent employees from quitting work without notice, and this is true on principles of justice without reference to the justice of the strikers' cause. A demand for an advance in wages may be of itself the highest justice, but attempts to enforce that demand may be in themselves the grossest injustice. The end does not justify the means in this, any more than in other conditions of life. No act of the Brotherhood of Locomotive Engineers caused so much adverse criticism, or occasioned the loss of the good will of the public, as the desertion of their trains at midnight by the engineers of the New Jersey Central Railroad in 1876. It was an indefensible act, and one that some of the officers of the brotherhood regret. It will be well for both parties to possible future labor struggles, that their rights and duties should be as well defined in this country as they are in England.

THE NEW GERMAN PRESERVING FLUID.

A new fluid, to be used for preserving dead bodies, has recently been devised, the patent for which the German Government has purchased, and given to its people for their free benefit. Several criticisms upon the formula for its manufacture have appeared in foreign journals. Mr. Martenson, of St. Petersburg, says: Alum forms one of the constituents of the liquid; probably potassic alum is meant, and in place of potassa probably the carbonate. But under the circumstances, all the alumina of the alum is precipitated, so that the liquid does not retain any in solution. On preparing large quantities of the solution, the labor of straining or filtering from the deposited alumina is very onerous. It is much better to omit the alum, and to substitute at once that substance which was produced by it in the original liquid, namely potassium sulphate. A portion of the alum may be replaced by borax, so that the constituents will be the following:

	Parts.
Water	620
Borax	10
Sulphate of potassa	4
Salt	5
Nitrate of soda	3
Carbonate of potassa	9
Arsenious acid	2
Glycerine	300
Alcohol	50

The arsenious acid and carbonate of potassium are dissolved together by the aid of heat, and added to the solution of the other ingredients.

TABLE SALT AN APERIENT.—Physicians have for a long time known that common table salt is an efficient aperient in ordinary cases of constipation. In a lecture on a case of nervous affection, Dr. Weir Mitchell, of Philadelphia, said that he had recommended the patient to take each morning on rising a tumblerful of water—cold, to prevent nauseating—in which was dissolved a teaspoonful of table salt. "This simple aperient," the doctor adds, "I frequently employ in cases of constipation, and generally find it efficient. There is great advantage in starting the bowels and in keeping them in a soluble condition, particularly in cases of nervous disorder in woman, as it sometimes clears up obsecure points in the case, and at all events eliminates one source of error."

SAND is worked with cement to keep the latter from cracking, to harden it and to lessen the cost of the mass.

EYE-SIGHT.

Milton's blindness was the result of overwork and dyspepsia.

One of the most eminent American divines having for some time, been compelled to forego the pleasure of reading, has spent thousands of dollars in value, and lost years of time, in consequence of getting up several hours before day and studying by artificial light. His eyes never got well.

Multitudes of men or women have made their eyes weak for life by too free use of the eye-sight, reading small print and doing fine sewing. In view of these things, it is well to observe the following rules in the use of the eyes:

Avoid all sudden changes between light and darkness.

Never begin to read, or write, or sew for several minutes after coming from darkness to a bright light.

Never read by twilight, or moonlight, or of a very cloudy day.

Never read or sew directly in front of the light, or window, or door.

It is the best to have the light fall from above, obliquely over the left shoulder.

Never sleep so that, on the first waking, the eyes will open on the light of a window.

Too much light creates a glare, and pains and confuses the sight. The moment you are sensible of an effort to distinguish, that moment cease, and take a walk or ride.

As the sky is blue and the earth green, it would seem that the ceiling should be a blueish tinge, and the carpet green, and the walls of some mellow tint.

The moment you are prompted to rub the eyes, that moment cease using them.

If the eyelids are glued together on waking up, do not forcibly open them, but apply the saliva with the fingers—it is the speediest diluent in the world—then wash your face and eyes in warm water.—*Exchange.*

This has been going around for about 10 years, and its ownership, we guess, is lost; but it is good enough to go on indefinitely.

THE GERMAN STANDARD FOR PORTLAND CEMENT.—From a paper read by Mr. John Grant, an English authority on cement, is taken the following brief summary of the requirements adopted in Germany for Portland cement: "In January, 1877, a committee, appointed the year before of four associations of engineers, architects, and manufacturers of cement, etc., had, at their meeting in Berlin, agreed upon a series of rules to be observed in the production and supply of cement. By these, the weight to be supplied in casks and sacks was determined, and certain tests established for the quality of cement, particularly as to its fineness and tensile strength. The latter was to be tested by briquettes of uniform shape and dimensions—five square centimetres breaking area—made of cement and sand, in the proportion of one part of cement to three parts of sand. The apparatus for this purpose was agreed upon. The age of the briquettes when tested was to be twenty-eight days. The cement was to be ground so fine that the residue on a sieve of 900 square centimetres, equal to 72.2 per lineal inch, should not exceed 25 per cent. This was afterwards reduced to 20 per cent. The sand for testing was to pass through a sieve of 60 meshes per square centimetre, and to be retained on one of 120 meshes per square centimetre, equal to about 20 and 28 meshes per lineal inch. The tensile strength after twenty-eight days was at first eight kilogrammes per square centimetre, equal to about 114 pounds per square inch, but was afterwards increased to ten kilogrammes per square centimetre, or about 142 pounds per square inch. There could be no doubt that the standards thus established for fine grinding, and for testing the cementitious value of cement when mixed with a large portion of sand, had exercised a beneficial influence on the quality of the Portland cement manufactured and used in Germany. This result has been arrived at by a combination of the knowledge and ability of those who produced, and those who had to use this important article. The same standard rules, with slight modifications, were afterwards adopted in Austria. To these standards all cement manufactured in or imported into countries must conform. In England engineers and cement manufacturers had not been idle, and the subject was now much better known than it was twenty years ago."

THE LARGEST SEWING MACHINE IN THE WORLD.—Mention has already been made, says *Design and Work*, of the modifications of the Singer sewing machine to adapt them to certain kinds of work. The latest of these we must allude to more prominently, and introduce the reader to the largest sewing machine in the world. This gigantic stitcher has just been completed, and may thus be described:—The machine weighs over four tons, and is in some respects of a new design, uniting much simplicity of construction with great strength of parts. It is adapted for general manufacturing purposes of the heavier sort, although specially made for stitching cotton belting, an article which is just now taking the market as a cheap and serviceable institution for gearing and the ordinary leather belting. The material used is of great strength and toughness, and is sewed together in plies or layers up to an inch in thickness. The belting in being sewed together is passed through heavy feed rollers some nine inches in diameter and over eight ft. in length, getting stretched and pressed in the process. There are two needles at work, with two shuttles, and the shuttles can be removed from the bottom without disturbing the overlying plies of belting. The rollers between which the work passes are actuated by reversible worm and cam motions, and the machine has, in addition to these roller-feeds, what is known as a top-feed motion, suitable for a lighter class of work. The stitch, as in the ordinary sewing machine, can be easily adjusted from one-eighth inch upward, and the pressure of the rollers on the work passing through the machine can be regulated at the will of the operator. The machine, which is driven by steam, has been made for a manufacturing firm in Liverpool.

THE USE OF COPPER BY THE ANCIENTS.—Copper is widely spread over the face of the earth, and man, in all ages, has adapted it to his wants. It was one of the greatest articles of commerce with the Phœnicians, who derived a large supply from the mines of Nubia, that at one time supplied the whole of the known world, and combined with it the tin obtained from the islands of Great Britain. It was used by some of the northern nations of Europe in the fabrication of weapons, at a period and under circumstances when steel appeared to be more precious than gold. This has been illustrated in Denmark, by the opening of many Scandinavian tumuli of very remote ages, and from which have been collected specimens of knives, daggers, swords and implements of industry, which are preserved in the museum at Copenhagen. There are tools of various kinds, formed of flint, or other hard substance, in shape resembling our wedges, axes, chisels, hammers and knives, the blades of which are of gold, while an edge of iron is attached for the purpose of cutting. Some of these tools are formed principally of copper, with edges of iron, and in many of these implements the profuse application of copper and gold, when contrasted with the parsimony evident in the expediture of iron, seems to prove that at that unknown period, and among the unknown people who raised these tumuli, gold as well as copper were much more common products than iron.

RESPIRATION AFFECTED BY FOOD.—A very careful examination by Dr. Speck, of the changes produced in the respiratory process by the use of fatty food, of coffee, quinine, alcohol and water, and by the inspiration of air respectively rich in carbonic acid, poor in oxygen and rich in oxygen, has led him to the following conclusions: With an increased proportion of hydrogen in diet, the amount of air inspired and expired decreases, and nutriment, such as sugar, which contains little hydrogen in comparison with their oxygen, involves more exertion of the respiratory organs than such as are rich in hydrogen like the fats; the more carbon predominates in the food, in proportion to hydrogen, the more air is exhaled in proportion to that inhaled; the more carbon increases in the diet in proportion to hydrogen, the more carbonic acid is evolved and the more oxygen is taken up—while the richer the diet in hydrogen the less oxygen is required. An atmosphere containing 5% or 6% of carbonic acid could be breathed for some minutes without oppression; at 11·51% great exertion would be needed to breathe for one minute; at 7.2 all carbonic acid produced in the body is retained in the blood.

THE VALUE OF BRIC-A-BRAC.—A *bonheur de jour* table, 2 feet wide 18 inches deep, and 2 ft 9 inches high, beautifully and elaborately decorated, one of the Welbeck "properties" inherited by the Duke of Portland, has been valued for probate at 10,000 guineas. There is nothing very astonishing in this, for when, during the bankruptcy of the late Duke of Newcastle, there was a dispute as to the ownership of a cup, whether it belonged to the Duke or to Mrs. Hope, some one suggested that such a trifle was not worth so much discussion, whereupon it came out that at the death of Mr. Henry Hope the said cup had been valued at £10,000.

BOILER EXPLOSIONS FROM FAULTY CONSTRUCTION.

One of the clearest cases of a boiler explosion where the cause can be traced directly to faulty construction, and which affords an instructive lesson to would-be improvers of the steam generator where they are tempted to depart from generally accepted rules of construction, is described and illustrated in what follows:

The boiler referred to was a patent boiler, concerning which the most extravagant claims were made before half a dozen of them had been actually put in service. An explosion which occurred shortly after the first introduction of these boilers, while it justified the opinion of the inspectors of the Hartford Steam Boiler Inspection and Insurance Co., who have steadily refused to pass them, on the ground that they were unsafe, did not interfere with the pertinacity with which the makers affirmed their excellence.

The particular boiler whose history is about to be narrated, exploded at Holyoke, Mass., November 11, 1879. Its dimensions were as follows: Shell, 6 feet long; upper part, 22 inches diameter; lower part, 30 inches. In this there were 38 tubes, 6 feet long by 3 inches diameter; shell plates, ¼ inch thick, tubes, 5-16 inch thick. The four braces—the ends of which are visible at A A. Fig. 1—were 9 inches wide and of 5-16ths iron. The mode of fastening these braces is seen in Fig. 2, where they are shown attached below the small reverse curve of the waist, by means of four of the seam rivets, to each side of the boiler. The back tube plate was stiffened by short bars of angle iron, riveted on transversely above the tubes. The shell, as will be seen by consulting Fig. 3, was composed of three plates, two of which formed the cover of the upper part, and the third that of the lower part, a continuous seam on each side joining the upper plates to the lower one.

The plan of construction, therefore, shows a departure from the rules hitherto made use of, the idea of the inventor being apparently to construct a boiler similar to the Union boiler, with a continuous connection or leg. The execution of this idea, however, involves a fatal weakness of construction, which will shortly appear, and which the event has shown, justifies the Hartford company in their refusal to insure them. By reference to Fig. 1, it will be seen that the outline of the end plates, which gives general outline of the boiler shell, is that of two parallel, incomplete and intersecting cylinders. The tendancy of an internal pressure upon such a form as this must manifestly be to distend this compound form into that of a simple cylinder; and this must necessarily bring a powerful strain upon the angles of the braces (Fig. 2), tending to straighten them out. The effect of this strain upon the rivets fastening the braces to the seam, will be to pry them downward as the angle of the brace yields to the straightening effect of the strain—something like the effect of a "claw bar" on a spike in drawing it from the fastenings. The correctness of this criticism will be obvious to any mechanical mind that studies the engravings, and further details of the settling of the boiler and its fittings are superfluous. The boiler was considered safe at 75 pounds working pressure, but at the time of the explosion the pressure was supposed to be from 40 to 50 pounds.

The theory of this explosion advanced by the Hartford company, seems to be so perfectly justified by the acts, that we entirely coincide with it, and give it without further comment: "One of the middle braces, the second or third from the end, became so weakened by frequent motions, caused by the straightening tendency of the internal pressure, that it gave way at the angle (where it will be seen from the drawing, Fig. 1, and three of them are broken off). The rest of them, a little less weakened, perhaps, by the same cause, gave way in turn immediately, having received a sudden succession to their load, and the shell yielded and broke at the middle of the long seam, which may also have been weakened along the margin of the inner lap, as indicated by the leak on the left side. The shell being now fairly open, the steam and water rushed towards the place of least resistance, which was outward and upward, carrying the shell plates before them and tearing them from the end plates. The bending of the upper tubes indicates the direction which the water about them took in escaping, as does also the tearing out of the entire upper row of tubes which, it will be seen from the one in sight on top of the cluster, were so much bent as to draw them from their setting in the tube plate. The four brackets which supported the boiler being below the opening, constituted the over-balancing resistance in the downward direction. Had the brackets been above the opening, the boiler would doubtless have gone high in the air, instead of tumbling over and over to the left, as observed by the attendant, who caught sight of it just before the whole scene was enveloped in steam and dust. This *hypothesis* seems to be so well supported by the facts that the word is almost a misnomer.

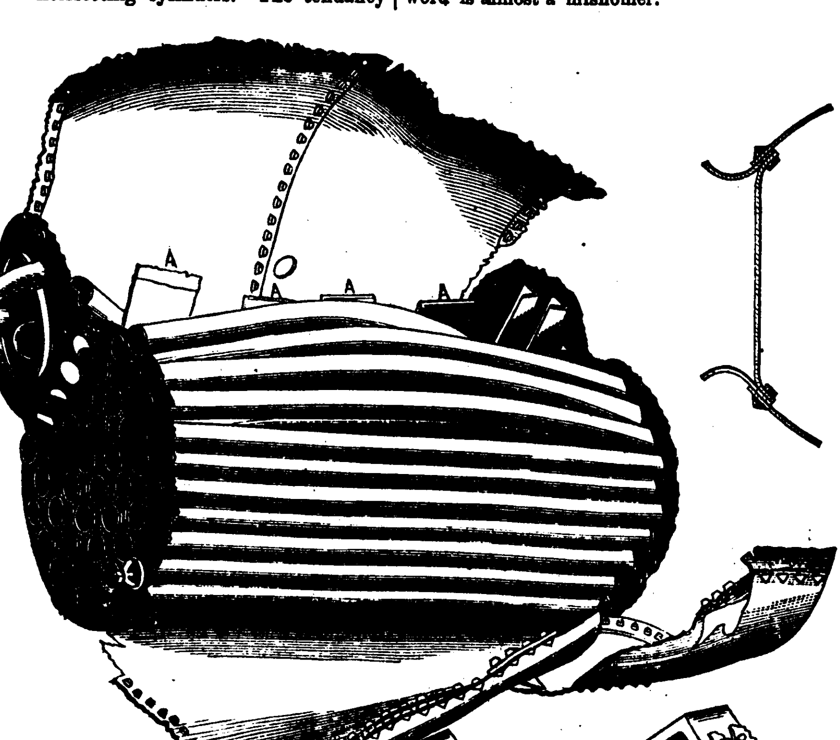
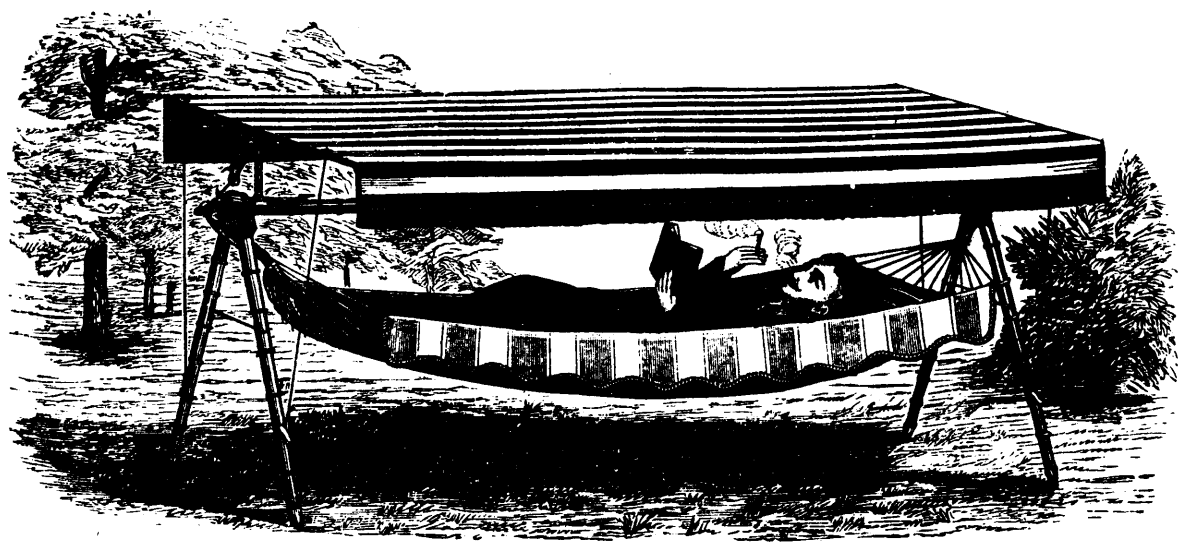


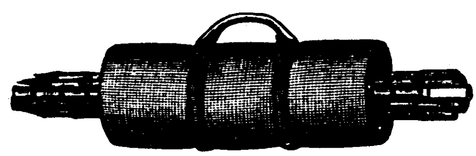
Fig. 2.

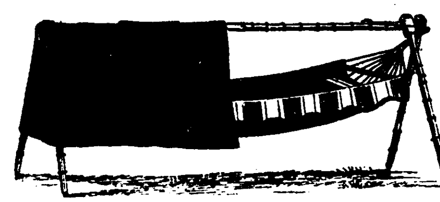
Fig. 1.



THE GWYNFE PATENT HAMMOCK-TENT.

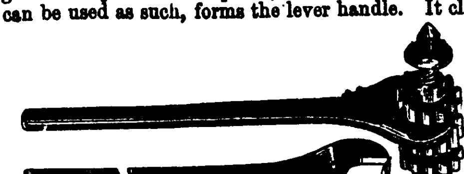
The season for "camping out" is once more at hand, and the tourist, in order to keep abreast with the requirements of modern travel, must needs set up for himself a more or less luxurious lounge, which he may use at discretion on the lawn, the sea-side, or the deck of a steamboat. Such an appliance, to be of any practical value, must possess the essential qualities of readiness of adjustment, perfect adaptability under varying circumstances, and positive immunity from the weather. Our attention has been called to a contrivance which embodies all these characteristics, namely the "Gwynfè" patent hammock-tent, supplied by Messrs. John R. Whitley and Co., of 7, Poultry, London, E.C., and of which we give illustrations. The great merit of this hammock-tent is that it can be fixed in position in one minute, while it will stand by itself anywhere, independently of ropes, trees, screws or pegs. The "Gwynfè" was originally designed to meet the want so long felt, by officers and others, of a portable weatherproof shelter and sleeping place in time of war, but at the same time equally available for numerous other purposes. The framework of the tent consists of several short pieces of ash or pine, fitted one into the other—an operation which takes only a few seconds—in such a manner as to form a compact, secure, and portable frame to which the hammock is slung, and over which the material forming the tent is thrown. The hammock itself is made of canvas, The operation of taking the hammock-tent to pieces takes less time even than that of putting it together, and can, by placing the pieces of framework side by side, and rolling the hammock and tent neatly around them, be formed into a light and portable parcel. The "Gwynfè" can be placed in any position, or readily removed to another, on grass as well as on rock, on the floor of a room as well as on the muddiest soil. It is equally suitable for the field in war, or for the lawn in peace; while it will prove invaluable as an accessory to field hospital appliances, and can even be used as a manger for foraging horses. In the late Russo-Turkish War it was found that the mattrasses in general use by the officers engaged, were no protection whatever from the dampness of the ground, the inclemency of the weather or the irritating attacks of insects, against all of which the "Gwynfè" is completely proof. Sportsmen, gamekeepers, herdsmen, squatters, ambulance surgeons, and invalids,—in fact, everybody who does a little "camping out," will find this contrivance of immense use in securing ease and comfort in the open air. It would be a great boon to the tired travellers crossing the prairies of the Australian continent, and useful as a domestic "fixing" in the bungalows of India. At home even hotel-keepers, or proprietors of sea-side lodging-houses, might turn it to profitable account whenever there is a sudden arrival of visitors in a full house, for with a "Gwynfè" within reach a really comfortable bed may be "rigged up" in a few minutes.





NEW RATCHET BRACE.

Mr. T. Sword, of Cable street, Liverpool, is introducing a new patent ratchet brace, "The Ne Plus Ultra," which seems to possess undeniable merits on the score of simplicity, strength, durability and cheapness. It will be seen that the pawl and its hinge, and the spring, in the common ratchet brace are entirely dispensed with, and the ratchet action is accomplished by two ratchet-toothed wheels on the journal, a little distance apart, and forming with the journal one piece; while an ordinary spanner, which can be used as such, forms the lever handle. It clasps the



journal between the two wheels, and a lug projecting from each side of the spanner takes into the teeth of the wheels, driving the journal in one direction, and sliding back over the teeth in the other direction. By having three instead of two ratchet wheels, two spanners can be used, and thus a two-handed continuous action is obtained. A curved spring is attached to the open end of the spanner to hold it on if required, though this may be dispensed with. This improved ratchet is also applicable to screw-jacks, and for various other purposes where a ratchet action is used.

THE THERMOMETRIC BUREAU.

We desire to call the attention of our scientific readers to the following extract from a circular, published by the Thermometrical Bureau, Yale College Observatory, New Haven, Connecticut, relating to the importance of the verification of Clinical Thermometers to the medical profession, to whom the true temperature of a fever patient is of great importance to ascertain correctly.

Statistics show that several thousand thermometers of refined construction, and graduated on the stem to 0°.2 F. or thereabouts, are annually procured by the medical practitioners of our country alone for physiological researches and daily practice. The majority of these thermometers are newly made (within six months), and their verification depends on inferior (from the scientific standpoint) thermometers in the hands of individual makers. It is needless to say that the readings of such thermometers have little value in indicating the true temperature of a patient, or affording data in cases which the physician wishes to describe in print.

The makers of thermometers in our country have been in general content to use for their standards thermometers which have been compared at some foreign observatory, or with some more easily accessible instrument in which they place confidence, in the hands of a friendly neighbor. Thus it happens that many thousand American clinical thermometers have been sold, which do not depend upon a comparison with a recognized standard for their scale readings. The result has been that the American instruments have suffered in the estimation of scientific practitioners. This is not so much the fault of the American makers as their misfortune in not having the same facilities offered them by the properly equipped observatories this side of the water, which their favored competitors enjoy abroad.

The meteorlogical observers in this country have now no common standard of easy access; and it seems eminently proper that the observatory should undertake to be useful to the medical profession and the meteorologists in this country, and afford the means of comparison desired. With this end in view the observatory has accepted the aid of the Board of Directors of the Bache Fund of the National Academy in obtaining the standards of the foreign observatories, and has made provision for the constant determination of the errors of the standards themselves. The following is the official circular of the Thermometric Bureau :—

CIRCULAR CONCERNING THE VERIFICATION OF THERMOMETERS.

This Bureau has been established by the Corporation of Yale College, at the recommendation of the Board of Managers of the Winchester Observatory, in order to afford desired facilities for adequate verification of thermometers.

Thermometers will be received at the observatory for the purpose of comparison with the observatory standards, and certificates of comparison signed by the Astronomer in charge will be issued with thermometers so compared. These certificates will contain a statement f the correctness to be applied at intervals of five or ten degrees of the thermometer scale to cause it to have the same reading as the observatory standards. In general these corrections will be expressed in tenths of a degree Fahrenheit, or in twentieths of a degree centigrade.

Thermometers sent for verification must have a name and number engraved upon them ; and thermometers which are not graduated on the glass stem must be of sufficiently good workmanship to satisfy the observer in charge that the scale will not suddenly change with reference to the glass stem of the thermometer tube, with ordinarily careful usage.

The Board of Managers have established the following scale of charges for this service, which includes the hall mark and the certificate : —

Standard Meteorological Thermometers..	$1,00
Ordinary Meteorological Thermometers..	,50
Ordinary Maximum Thermometers......	,75
Ordinary Minimum Thermometers.......	,75
Clinical Thermometers...............	,50

There will be a deduction of one-fifth of the above charges where more than eight thermometers of one kind are received at the same time. In the case of clinical thermometers the charge will be four dollars per dozen when not less than two dozen are sent at a time.

For other thermometers than the above the charges for verification will be furnished on application.

The letter of advice accompanying thermometers sent for verification should contain the maker's name, the number of each thermometer, and full directions for re-shipment.

All proper precautions are taken by the Board of Managers to guard against loss or injury ; but as it is manifestly inexpedient that a University Corporation should be responsible for property in its care for such a purpose, it is to be understood that all risks are assumed by the person sending the thermometers.

LEONARD WALDO,
Astronomer in Charge.

BACTERIA IN THE AIR.

M. Miquel has succeeded in seizing and numbering the spores or eggs of bacteria, and while confirming M. Pasteur's observation; that they are always present in the air, shows that their number present incessant variations. Very small in winter, it increases in spring, is very high in summer and autumn, then sinks rapidly when frost sets in. This law also applies to spores of champignons ; but while the spores of moulds are abundant in wet periods, the number of ærial bacteria then becomes very small, and it only rises again when drought pervades the soil, a time when the spores of moulds become rare. Thus, to the *maxima* of moulds correspond the *minima* of bacteria, and reciprocally. In summer and autumn, at Montsouris, one finds frequently 1,000 germs of bacteria in a cubic metre of air. In winter the number not uncommonly descends to four and five, and on some days the dust from 200 litres of air proves incapable of causing infection of liquors the most alterable. In the interior of houses, and in absence of mechanical movements raising dust from the surface of objects, the air becomes fertilizing only in a volume of 30 to 50 litres. In M. Miquel's laboratory, the dust of five litres usually serves to effect the alteration of neutral bouillon. In the Paris sewers infection of the same liquor is produced by particles in one litre of the air. These results differ considerably, it is pointed out, from those published by Tyndall, who says a few cubic centimètres of air will, in most cases, bring infection into the most diverse infusions. M. Miquel compared the number of deaths from contagious and epidemic diseases in Paris with the number of bacteria in the air during the period from December, 1879, to June, 1880, and certainly, each recrudescence of the ærial bacteria was followed at about eight days' interval by an increase of the deaths in question. Unwilling to say positively that this is more than a mere coincidence, he projects further observations regarding it. M. Miquel further finds (contrary to some authors) that the water-vapour which rises from the ground, from rivers, and from masses in full putrefaction is always micrographically pure; that gases from buried matter in course of decomposition are always exempt from bacteria ; and that even impure air sent through putrified meat, far from being charged with micropes, is entirely purified, provided only the putrid filter be in a state of moisture comparable to that of earth at 0·30 metres from the surface of the ground.

TO CHANGE THE COLOR OF FLOWERS.—The natural color of flowers may be changed by exposing them to the diluted fumes of ammonia. Most of the blue, violet and light crimson flowers turn to a splendid bright green. Dark crimson clove pinks turn black, other dark red flowers turn dark violet, all white flowers turn sulphur yellow. This change of color is especially beautiful when they are variegated or the single petals possess a different color. As soon as the new color is fully developed, the flowers must be dipped at once in cold water, when they will keep their new shade for two or six hours ; by degrees then their natural color returns. If flowers be exposed to the vapors of ammonia for one or two hours they turn a dirty chamois, which is permanent. Blue, violet and red asters are dyed or turned intense red when they are exposed to the fumes of muriatic acid gas ; it takes from two to four hours or more before the shade is fully developed. The flowers are then removed to dark cool rooms to dry.

TO PRESERVE AND RENOVATE RUBBER INSTRUMENTS.—It is well known that many articles and instruments made of rubber are apt to become dry with time, and to crack, grow brittle, and lose all elasticity. According to a Russian journal, this may be prevented by the use of a simple mixture of one part aqua ammonia with two parts of water ; in which the article should be immersed for a length of time varying from a few minutes to one half or one hour, until they resume their former elasticity, smoothness and softness.

WELDING IRON AND STEEL.

German engineers are now discussing eagerly a question which has seriously engaged attention in this country, and though nothing conclusive has been reached abroad, it will be profitable to review briefly the conflicting opinions offered, based upon experience and in some case upon experiments of a specific character. The last German engineer to take up the subject is Herr C. Petersen, of Eschweiler, from whose paper, read before an association of railroad engineers, we glean the following: The welding of iron is dependent upon its property to assume a pasty state within a certain range of temperature, and it may be stated in a general way that the facility with which the welding may be performed is dependent upon the duration of this peculiar condition.

Leaving out of consideration other circumstances affecting welding, it is conceded by the majority of metallurgists, that an increase in the percentage of carbon in the iron impairs the property of welding, and it is generally believed that when 2% is reached it ceases entirely. It might be concluded that therefore it is desirable to keep the carbon within the lowest limits attainable, but there is some diversity of opinion on this point, because a second important condition for good welding comes into play. It is necessary, in order to unite two pieces of iron, to make the surfaces to be welded free from any coating of oxide, a matter which is generally reached by fluxing the oxide by means of sand, borax, etc.; and some hold that a certain percentage of carbon is necessary in order to afford material for the reduction of this oxide.

Wedding, among others, maintains that such is not the case, and the silicate of iron contained in wrought iron plays an important role. These theoretical considerations have quite recently become of considerable interest, because they may offer a clue to detecting the reason why the steel produced by the open-hearth and Bessemer processes is generally inferior as regards welding power to wrought iron, an inferiority which stands in the way of the more general adoption of steel in place of wrought iron. The former, it is true, can be welded, but there are many practical difficulties. Certainly steel-headed rails show a case of good welding, and tires, tubes, etc., have been made of Bessemer steel on a large scale, but still steel cannot compare in this respect with wrought iron. It is said that hot working in the Bessemer converter or open-hearth steel furnace favorably affects the welding power, and this is explained by pointing to the fact that hot steel will contain a smaller amount of oxides mechanically mixed than that produced at lower temperatures.

Herr Petersen claims that silicon is injurious, while Herr Koehler, of Bonn, during the discussion following the reading of the paper, held that it was not alone not injurious, but actually favourable for good welding. Herr Helmuth took a different view, and stated that at Bochum, during a series of experiments in an open-hearth furnace, they tried keeping the silicon low, but reached no results, and were similarly unsuccessful by increasing the percentage of phosphorus. They then turned to the Bessemer process and commenced overblowing, which improved the welding, though not in a sufficient degree. By using oxides of iron, however, they obtained much better results, but they did not follow out the matter, because they found that pieces welded together had a yellow red fracture near the weld, and Herr Gresser, of Grafenberg, added that the same tendency to red-shortness was observed by them when making a weldable material in the open-hearth furnace. In using the Terrenoire alloy they found that a good product was obtained by adding about four times as much manganese as silicon. It was, however, abandoned on account of its high price.

Herr Petersen concludes by giving some interesting data in regard to the influences of arsenic upon the welding of iron. A lot of inch rod was rejected on account of difficulty in welding, and it was found that the heated rods had a fatty lustre, and that two rods laid one upon another slid off as though the surfaces were polished. This took place, although the balls in the puddling furnaces and the piles welded well. The cause of this anomaly was found to be that the injurious effect of the arsenic comes out strongly only after the carbon has been considerably reduced. The following analyses are given as representing the composition of the pig used in making these rods, the first being white, the second gray pig:—

Sulphur	0 774	1.843
Phosphorus	trace	trace
Copper	0.090	0.580
Arsenic	4.250	5.980
Antimony	1.145	1.068

—*Iron.*

OLEOMARGARINE.

As most of our readers will be aware, the manufacture of artificial butter from beef fat, has, within the past few years, attained to the rank of an important industry. Like every other new departure from well-worn grooves of custom, it has had to contend with much opposition, which in this case has been the more severe as the product, being designed as an article of food to take the place of natural butter, has been bitterly assailed and denounced as unwholesome, and even dangerous. The utterly baseless nature of these denunciations, coming as they did, and still to some extent do, from interested scources, has been sufficiently demonstrated by the enormous growth and extension of the manufacture of oleomargarine throughout the country, and by the almost unqualified endorsement of the entire chemical fraternity as to the wholesomeness of the product as an article of food, and as to the value of the industry in giving an enormously greater value to animal products that hitherto have been used for less important purposes. With these views we entirely concur, and from our knowledge of the subject, feel warranted in the opinion that the oleomargarine industry is worthy to rank in importance with the manufacture of sugar from the beet root, and a few other equally beneficent industries that chemistry has conferred upon us. As it may be of some interest to certain of our readers to know the grounds upon which, this opinion is based, we will give in brief a review of the process of making this new article of food.

To begin, we will refer to the fact that in the operation of fattening beef-cattle for the market, a large surplus of fat is stored away in various parts of the body—much in excess of our requirements for food, or for cooking purposes. This excess has been hitherto altogether lost as an article of food, the only uses to which it could be put being to convert it into tallow, to be used in the production of soap and candles, or to be used for lubricating and similar crude applications. The wholesomeness of beef fat as an article of food being universally admitted, it is not surprising that it occurred several years ago to M. Mége, a French chemist, to endeavor to save to the food supply a portion of the immense quantities of fat used for the crude purposes above named. He was led to this thought by the knowledge that the only essential differences between the oil of butter and the oil of suet, were that the former contained a small percentage of certain compounds (butyric) which impart to it some of its peculiar flavor, and that it contained a much smaller proportion of the solid stearine to which the hardness and granular quality of suet are due. The result of Mége's study of the interesting problem of converting the surplus fat of beef cattle into a food product, after many difficulties had been encountered, were ultimately quite satisfactory.

Mége's process is as close an imitation as possible of the process of natural butter-making. It consists substantially of three steps: 1st, The separation from the oily fat of suet of the cellular tissue and the excess of the stearine; 2nd, the addition of the necessary proportion of butyric compounds, to give the peculiar butter flavor; and 3rd, the solidifying of the butter-fat without grain, and the addition to it of the necessary proportions of water, salt and coloring matter. In this proper conduct of the Mége process, as perfected, the resulting product is a compound which is substantially the same in composition, appearance and flavor as butter churned from cream, without the addition of any deleterious substances, and without subjecting the substances handled to any process whereby its wholesomeness could be in any way injuriously affected.

The following is a description of the Mége process as carried on at the extensive works of the Commercial Manufacturing Co., at West 48th street, North River, this city. The process begins with the selected fat from abattoirs, which is received at the oleomargarine factory within a few hours after the killing. The first operation consists in thoroughly washing the fat from adhering blood and other impurities, which is done by soaking first in tepid water, then thoroughly washing in cold water. The pieces rich in oil are then carefully selected for butter-making, being severed from the pieces less rich in oil by a skilful cut, and the last named are thrown into tubs that find their way to the tallow factory. The fat selected for butter-making, after another washing, is elevated to the floor above, where it undergoes the process of hashing and melting. The hashing machine is simply an iron cylinder provided with a number of revolving knife-blades, which cut up and completely disintegrate the fat as it is fed in at one end and forced out through a perforated plate at the other. The thorough breaking up of the tissues that has here taken place, is a very important step in the operation, since the oil separates from the fat in this condition at a very low temperature, thus avoiding the necessity of a prolonged application of heat to effect the separation, as has hitherto been necessary in the melting of tallow. The effect of such excessive heating would be the development of a rank, tallowy flavor, which would be very objectionable.

The disintegrated fat is melted in cauldrons, which are surrounded with water, and the water being heated by steam, effects the melting of the fat when the temperature has reached 122° to 124° Fah. When the fat is completely melted the contents of the cauldrons are allowed to stand until they deposit the fragments of membrane, which gathered on the bottom, forming "scrap." On top is formed a thin layer of a white emulsion of oil and water, which is removed, and the clear yellow oil is drawn off in vessels which are removed to the press-room. Here they are allowed to rest while the oil granulates by the crystallization of its stearine, which is allowed to take place at a temperature of 85° Fah. The melting process occupies about two or three hours, and the granulation about 24 hours, or even longer.

The next step is to remove the separated stearine from the refined fat by straining under pressure. This is done by placing it in cloths set in molds, and placed on galvanized plates in a series of presses. When these are filled, the packages are subjected to a gradually increasing pressure, under which the fluid oil is expressed, leaving the hard cakes of stearine in the cloths from which they are subsequently removed by a dexterous flirt of the cloth.

The resulting oily product, is a clear, sweet, yellow oil, substantially the same as the oil of butter. In this condition it affords an excellent oil for cooking purposes, and formerly the larger portion of the product of the Commercial Manufacturing Co. was packed in this form for exportation.

To convert the butter-oil into butter, it is next churned with milk for about 20 minutes, by which it is thoroughly emulsionized or broken up into minute globules. At this stage, also, a small quantity of anatto is added to give a richer color to the product. The emulsionized oil is then drawn off into a tub of pounded ice, in which it cools suddenly without granulation. Here it is allowed to remain for two or three hours, after which it is thoroughly worked over by hand, and the pieces of ice removed. To impart the proper butter flavor, the solidified product must still be provided with more of the peculiar butyric elements which give to fine natural butter its rich odor and flavor; and for this purpose it is again churned with about an equal quantity of milk. After this second churning, the butter goes through the same operations of working over, salting and packing, as ordinary butter, and the finished product—oleomargarine butter—when made in the manner above described, is substantially identical to butter made from cream, and while it is not equal in flavor to the best grades of dairy butter, it is preferable, both in taste and smell, to much of the butter sold in the shops; and its very deficiency in those peculiar butyric elements that lend to the finest creamery butters their agreeable odor and flavor, is in one sense an advantage, since it renders oleomargarine butter much less liable to become rancid.

Fig. 1 represents caul fat under the microscope, the crystalline nature of the adipose tissue being clearly seen, as also a globule of oil.

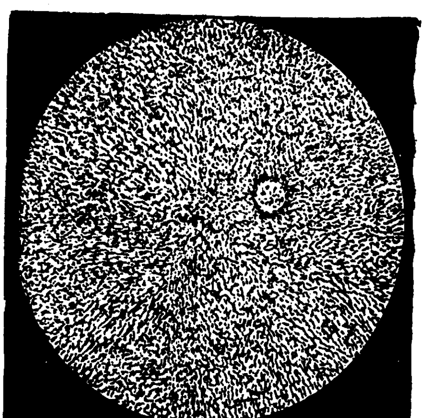


Fig. 1.

Fig. 2 represents oleomargarine before it is churned or what is known as oleomargarine oil. It will be seen from this plate that oleomargarine, before being churned, is entirely in a crystalline condition.

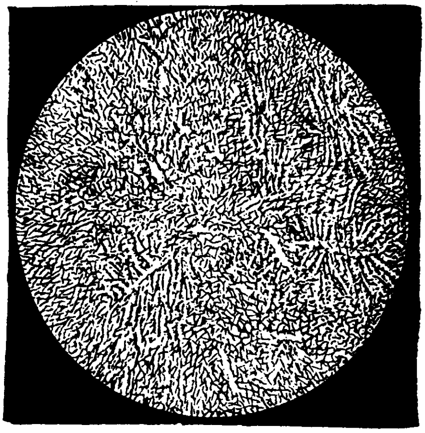


Fig. 2.

Fig. 3 represents natural butter first melted and then allowed to cool slowly to a solid condition. The microscope shows the same crystallization as in oleomargarine oil (Fig. 2) from which it in no way differs.

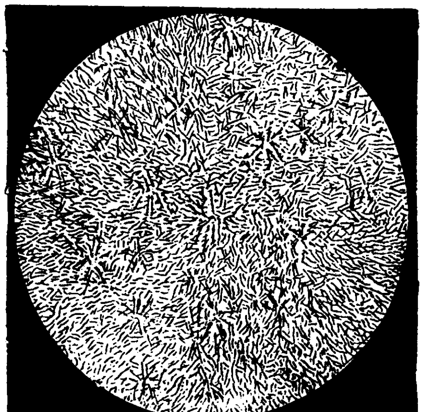


Fig. 3.

Fig. 4 represents oleomargarine butter and Fig. 5 natural butter. It will be seen by examination of the two figures, that they consist of an innumerable number of minute globules of varying size, and are substantially identical in appearance in all other respects.

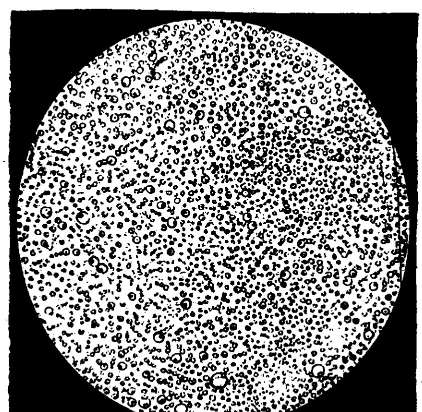


Fig. 4.

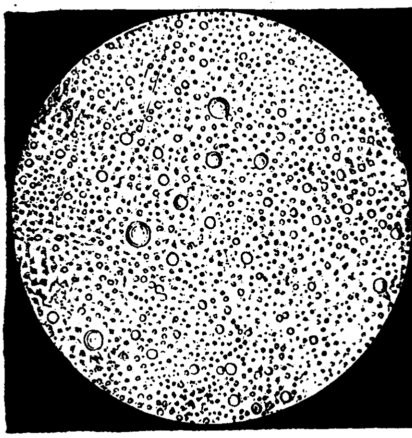


Fig. 5.

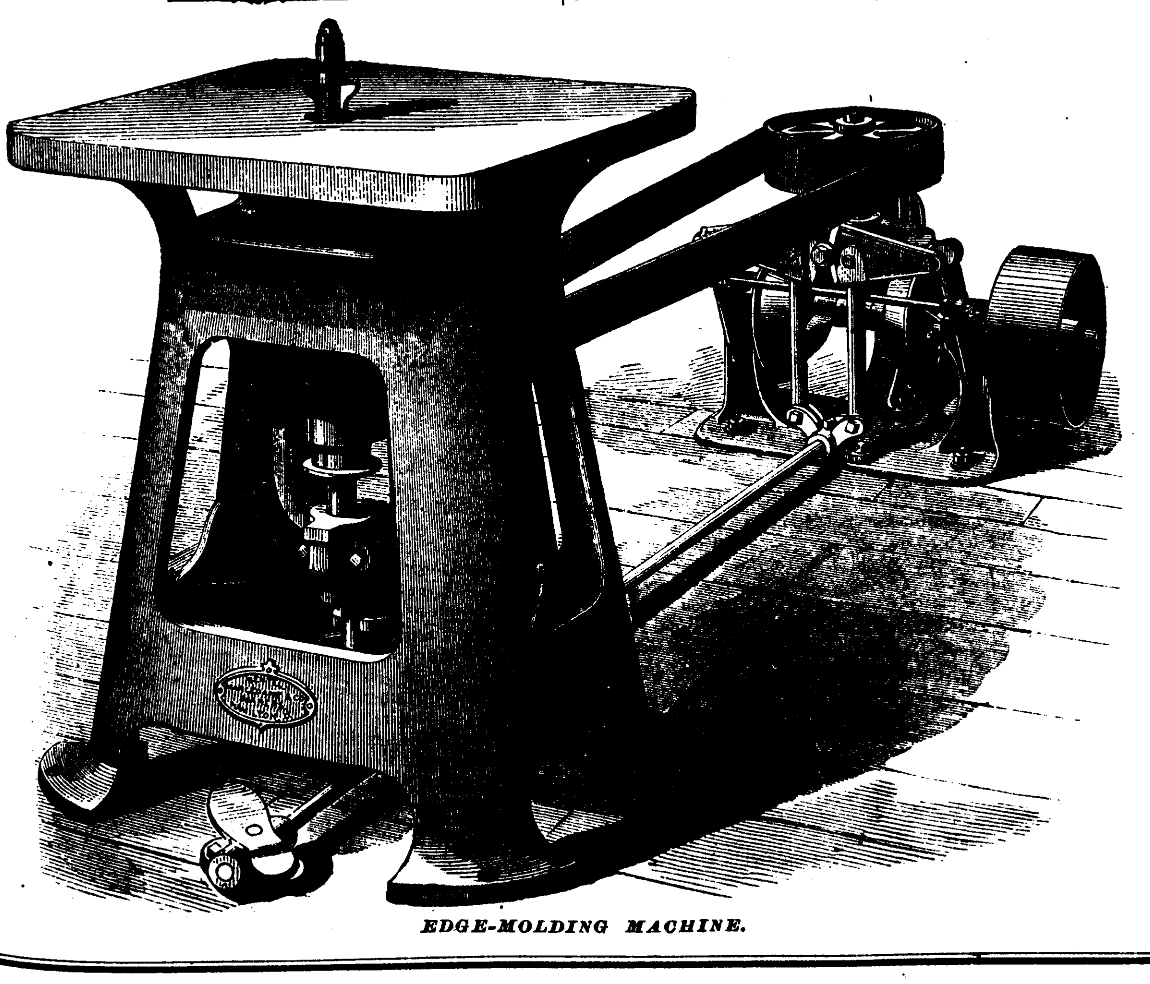
The manufacture of oleomargarine butter is now carried on in most of our leading cities and towns, and rapidly extending as the prejudices of the public, and the opposition of the dealers in low grade butters are overcome. Already the industry has reached proportions; adding in its present state many million pounds to the food supply of the country, more than double the money value of the crude production of the fat obtained from beeves.

We repeat in conclusion that we are fully convinced of the great value of the discovery of Mége, which, Chandler says, "marks an era in the chemistry of the fats," and place this opinion on record in the belief that it may serve to remove from the minds of some of our readers unreasonable prejudices or unfounded fear respecting a wholesome article of food.—*Manufacturer and Builder.*

EDGE-MOULDING MACHINE

One of the most useful wood-cutting tools is the edge-moulding machine, of which we here illustrate a representative machine manufactured by the well-known firm of Bental, Margedant & Co., Hamilton, Ohio, manufacturers of wood-working machinery. Nearly every shop throughout the land has one or more of these tools in operation, and although they are called by different names, such as, friezing machines, Yankee whittlers, inside molders, Frazer's radial cutters, irregular molders, upright molders, shapers, or shaping machines, they are the same tools, and produce the same class of work. These different denominations are evidence of the general usefulness and applicability of the tool. There are two classes of this tool known, the double-spindle molding machine and the single-spindle machine. The names indicate the principal difference in their construction. One carries two spindles, of which one rotates to the right and the other to the left; while the single-spindle machine only carries one mandrel, which rotates either to the right or to the left, at the will of the operator. The old way of arranging the counter-shaft of the single-spindle machine, for the purpose of changing the direction of motion of the spindle, is the application of two driving belts from the line-shaft, one of which is twisted and the other runs straight and holding one of these belts on either one or the other of the tight pulleys, and the other belt on the loose pulley of the counter-shaft.

Our illustration shows the counter-shaft arranged in a different manner. It will be seen that it belongs to the class of friction counter-shafts, consisting in this case of two horizontal miter wheels, made of manilla packing-board and iron, and of one vertical miter wheel of cast iron. The horizontal shaft, with its manilla wheels and driving pulley, rests in long rigid bearings, and remains, while in rotation, laterally stationary, while the upper or vertical friction wheel hangs in a strong, webbed-pivoted frame, which has its fulcrum back of the wheel. It requires very little motion and power to bring the upper friction wheel in contact with either of the horizontal wheels, and thereby change the direction of rotation of the horizontal wheel and pulley, and that of the upright spindle of the machine, to which



EDGE-MOLDING MACHINE.

it is connected by means of the horizontal belt shown in the engraving. The operator of the machine changes the motion by pressing the treadle either up or down. This treadle is connected to a rod passing under the frame of the counter-shaft. The attachment of a double crank at its end connects it, by means of rods, to a pair of eccentric arms, which hold on their peripheries pinned rollers fastened on the swinging frame of the upper horizontal wheel. This arrangement of changing the motion from right to left, or to rest, is positive quick-acting and unyielding. The whole arrangement is a decided improvement on the common friction counter-shaft now used. It also has all necessary arrangements for taking up wear.

The illustration shows the frame of the machine. It is cast in one solid piece of great strength, and stands broadly on the floor, taking up all vibration, and the spider-webs of the housings are of improved pattern. The spindle is adjustable, and can be raised and lowered, and set at different angles to the face of the table, so that the pitch of the molding can be changed and the cutting made easy for deep or flat moldings. The spindle carries cast-steel stocks, independent of the spindle, which enables the operator to use stocks of larger or smaller diameter, to suit the work. Solid immovable, solid reversible, or flat cutters can be used, or cutters of other machines can be interchanged.

The manufacturers furnish the machine, when so ordered, at moderate cost, with different attachments for doing special work.

For further particulars and prices, address the manufacturers as above.

TRAPS IN HOUSE DRAINS.

On Thursday last the Board of Health, of New York, met for conference a number of gentlemen interested in public hygiene, who had been invited to discuss the question of what the board, in the exercise of its legal discretion, should require of the builders of tenement and apartment houses to anticipate and avert the evils which follow defective drainage. There being no differences of opinion as to the property of requiring good work and good materials, or as to most details of plumbing work, the discussion chiefly centered on one point—Shall traps in house drains, cutting of the house from the public sewer, be required? On this subject Mr. J. C. Bayles spoke as follows:

MR. PRESIDENT: I scarcely dare venture the discussion of the matter before your board at this time. It is one in which I am very deeply interested, and while there is nothing which imposes upon the citizen the duty of holding opinions in accordance with those of public officers, especially if he has a good and sufficient reason for the faith that is in him, it is always a pleasure to agree with gentlemen so able, so conscientious and so devoted to the work of public hygiene. As a citizen I desire nothing so much as to strengthen the hands of the Board of Health and to give it in all good undertakings such moral support as I can. It is for this reason I dread to encourage discussion with it, fearing that it may be magnified by the enemies of this board and its work into opposition. I desire, therefore, to preface my remarks with the assurance that nothing which I may say is properly susceptible of an interpretation which would seem to place me in any other attitude than that of entire sympathy with this board in its efforts to reform all evils prejudicial to the public health.

I understand that the question we are invited to discuss is not the broad one of what system of drainage is best adapted for tenement and apartment houses, but what the Board of Health can properly require of the builders of such houses to anticipate and avert the evils which, if permitted in construction, must subsequently be discovered by inspection and corrected by order, or left to do their mischievous work unnoticed, in the absence of complaint. I should conceive it to be a matter of considerable difficulty for this board to lay down any general rules for the piping of tenement and apartment houses, for the reason that there is great variety in the arrangement of such houses, and wide differences in the views of builders as to what conveniences should be provided. Among the requirements which may probably be insisted upon are the use of good materials, the proper jointing of iron pipes, the carrying of all vertical lines of waste pipe to and through the roof, and a clear connection with the sewer by a continuation of the iron soil pipe, with no traps or other impediments to the flow of water freighted with matter intended for the sewer. This last suggestion touches the really vital point of this discussion.

I am informed that when complaint is made of defective drainage in a house under the jurisdiction of this board, the work of reforming the evils found to exist begins by requiring the owner to put in a trap somewhere between the cellar wall and the sewer, and to vent this trap above the seal in such a way as to obviate what, in the absence of such ventilation, would make a trap in this portion so obviously dangerous that no man could be found to favor it after giving the matter even superficial attention. Without an adequate vent above the seal, there would really be no room for discussion as to whether a trap in such a position was desirable, since it could never be anything else than a dangerous nuisance, giving rise to greater evils than would be likely to exist in its absence. With an adequate vent the objections to such a trap are in part met, but the question remains, "Is it even then necessary or desirable?"

I conceive the objection of this board to an untrapped house drain to be that which my esteemed friend, its president, has many times expressed to me and in my hearing—"I do not want the sewer ventilated through my house." Presuming that the associate commissioners share this feeling as regards their own dwellings, they doubtless consider it their duty to protect others from what they regard as a source of danger in their own cases. I honor their consideration for others, even though I discover no reason for the feeling which prompts it.

I do not need to remind you, Mr President, of the experiments so carefully made at your direction, and so frequently cited by you, to prove that there is no such thing as a *pressure* of air in sewers. I might, perhaps, take exception to the broad conclusion you seem to have drawn from these experiments, but, for purposes of argument, I prefer to concede that you are right. I might object to making the soil pipe of my house a safety valve through which a sewer should blow off great volumes of foul air compressed within, but if there is no such thing as a pressure of air in sewers—if, in other words, there are too many possible means of escape to permit within them a compression great enough to disturb the level of water held in a bent glass tube one end inserted in a sewer connection and the other open—I see no reason why I should fear to permit what air may enter my house drain at the sewer end to pass out through my soil pipe at the top. We are not dealing with pressures, by your own admission; we are not under the necessity of closing our pipes against rushing currents of air charged with organic poisons. If we were, no form of trap would stop them which did not, at the same time, oppose serious obstacles to the outflow of matter intended to reach the sewer.

The only possible object, and the ultimate function, of a trap depending on a water seal, be its dip more or less, is to close a pipe against what may be called natural currents of air. In the case of a trap in a house drain, it can have no other object than to close the house drain against currents tending to move in one direction or the other in obedience to natural laws. If we ask why it is put there, the answer would probably be: "To keep sewer gas out of our pipe systems." To this I reply without hesitation: To avoid an imaginary danger you not only sacrifice a tangible benefit, but you create conditions incomparably worse than those you seek to correct.

The term *sewer gas* is as convenient to the pseudo-hygienist as is the term "malaria" to people of another class. It means at once a great deal and nothing. As used, it commonly means nothing. The air of sewers, after all, is in no sense the worst enemy with which the plumber has to deal. Men work in sewers, and unless asphyxiated by carbonic acid, which is not, I believe, accredited with toxical properties, rarely suffer any inconvenience therefrom. The real enemy to life and health which does fatal work under the pseudonym of sewer gas, does not come from the sewer at all in most cases, but is born within the pipes which drain our houses. I am sure that every plumber of experience will say that he would rather work for hours over a clean connection with an average New York sewer and fill his lungs with the air coming from it, than lay open an old and foul waste pipe and be for even a few moments in close contact with the deposit lining it. We do not want to breathe the air of sewers if we can help it, but better that than encounter the greater dangers of air fouled by confinement in our house drains and waste pipes. I say this with the more confidence as I have often used the term sewer gas with unscientific looseness myself, meaning what a large experience has taught me to trace in most cases to sources within houses, in themselves so foul that a free access of sewer air, bad as it may be, would have practically purified them.

Now, Mr. President, let us deal briefly with the question of house drain traps in their practical aspects. Having no pressures to resist, it is no objection to such traps that they are incapable of resisting pressures. But every trap impedes the flow of water through water pipes and causes a foul accumulation in them. Their influence in this respect is most conspicuous in the case of pipes laid nearly horizontal, as in the case of house drains, and it may be seen by cutting out such a trap with a length of pipe at either end and, examining it. The length above the trap will be found foul, the length below the trap comparatively clean. If then, you do not by your seal oppose a barrier which air from the sewers cannot pass under a pressure due to even a slight compression, while by your trap you do oppose an obstruction to the outflow of drainage from the house, the practical advantage of a trap in this place is certainly not conspicuous.

Suppose you have no trap in your house drain, but carry an open and unobstructed tube from the sewer to and through the roof, what conditions have you? The sewer air is not commonly forced out under pressure, and if it was that pressure could not be maintained in a vertical tube open at both ends. You find that the air does not rush through your house drain and soil pipe, displacing seals and seeking escape into living and sleeping rooms through branch waste and fixtures, but moves in gentle, natural currents, sometimes up and sometimes down, according to circumstances. To ventilate sewers you do not need to blow air into them nor exhaust air from them. The failure of all such efforts has been conspicuous, and I do not need to refer you to the voluminous English literature on this subject, with which you are doubtless familiar. To ventilate sewers to the best advantage, it is only necessary to give them a chance to breathe. Why they should not breathe through pipes extending to the free air above our houses, as well as through the manhole covers over which we walk and ride, is a question to which I fail to find any satisfactory answer.

It will probably be claimed that by requiring ventilation for house drain traps above the seal, the objections which might otherwise hold against such traps are practically met with the single exception that a house drain so trapped contributed nothing to the ventilation of the public sewers. I could scarcely concede so much save for the sake of argument; but supposing it true, that absence of anything specifically objectionable in such a trap, so far as the individual housewife or tenant is concerned, would scarcely be a sufficient reason for imposing it as a requirement. I understand you are seeking advice from those of us who are enough interested in the matter to accept the honor of an invitation to meet you for conference, as to whether it is desirable or expedient for your board, in the exercise of its legal discretion, to require builders to put such traps in. I do not hesitate to respectfully offer it as my opinion that it is neither right nor proper to require a man to do an unnecessary thing, either when he is building his house or after it is done. I know of no evil connected with defective drainage which cannot be better corrected in other ways, or which would not be increased and intensified if reform began and ended with a trap in the house drain. The plumbing trade know this, and by forcing upon them a regulation which their practical experience teaches them is based upon a misconception, you weaken their confidence, alienate their sympathies and invite their hostility. Your honesty, sincerity and unselfish devotion to the public good, will not win for you friends enough to outnumber the enemies you would make by insisting upon a mistaken notion of this kind. The plumbing trade exercises a powerful influence in such matters with property owners. When you are right, as you are in most of your recommendations and requirements, you can afford to disregard the complaints of property owners and the clamor of the ignorant and prejudiced members of the craft. When you are even possibly mistaken you cannot, I think, wisely disregard the views of those who are neither ignorant nor prejudiced, but whose confidence rests upon sure knowledge.

As one deeply interested in the cause of public health and eager to co-operate with you in every possible way, I would advise abandoning the house-drain trap altogether. In new work, if you deem it expedient to prescribe materials and methods, insist upon good pipes, properly joined and open from end to end, with branch wastes properly trapped and vented at fixtures; in old work, correct the evils found to exist in the same way you would seek to avert them. If the individual citizen wants a trap in his house drain, there is no reason why he should not have it. The moral benefit of personal satisfaction at having interposed a few quarts of dirty water between him and the sewer into which his house drains, will probably offset any disadvantage resulting from it, but do not force this needless expense upon those who do not want it. Give property the benefit of the doubt, and property owners will the more readily support you in enforcing requirements which do not admit of intelligent objection.

Dr. Janeway reminded the speaker of a consideration which, in the estimation of the profession outweighed the practical objections to house drain traps which had been presented in the argument. It was believed that contagion, especially the germs of typhoid fever, were communicated through the public sewers, and instances were cited in which it was considered probable that such diseases had been communicated from house to house through the sewers.

Mr. Wingate presented some extracts from well-known English authorities favoring house-drain traps.

Mr. Partridge thought it unnecessary to complicate the discussion by citing English authorities, as American practice was far in advance of English practice in house drainage, and there were gentlemen present whose opinion was worth more on a subject of this kind than that of any English writer quoted.

Mr. Many approved the position held by Mr. Bayles, and cited examples showing that traps in house drains cause great accumulations of foul matter in them, leading to worse results than are found to exist when such traps are omitted.

Mr. Mead held the same views, and cited instances in which serious evils in house drainage had been corrected by taking such traps out.

Mr. Bayles, in reply to Dr. Janeway, held that the fact claimed, if established, did not prove the advisability of a trap in house drains. If what he had said of the mechanical objections to such traps was well founded, and the testimony of the experienced practical plumbers who had spoken was important on this point, it was eminently worthy of consideration by the board whether the danger of locking contagion in the house was not greater than that to be apprehended from a free connection with the sewer. It should be remembered that in this discussion they were dealing with the worst class of dwellings—the tenement and apartment houses occupied by many families. Was it not possible that the danger of spreading contagious diseases through such houses, by encouraging the retention of disease germs within their pipe systems, would result in greater aggregate mischief than could be traced to the spread of disease through sewers.

From this point the discussion became general and lasted nearly two hours, without eliciting anything new on either side. At the request of the president, Mr. Bayles formulated the objections to house-drain traps substantially as follows:

1. They retard the outflow of house drainage and cause foul accumulations which are not found in untrapped house drains—presuming good laying in each case.
2. Even when such traps are vented above the seal, the air passing through the pipes is, on account of their foulness, ordinarily worse than that from the public sewer passing through an untrapped drain and out through a vertical soil pipe.
3. They oppose no obstacle to the passage of sewer air when, from any cause, a pressure is brought to bear upon them.
4. The danger of locking contagion within tenement and apartment houses is possibly greater than that whieh is assumed to attend the passage of sewer air through soil pipes.

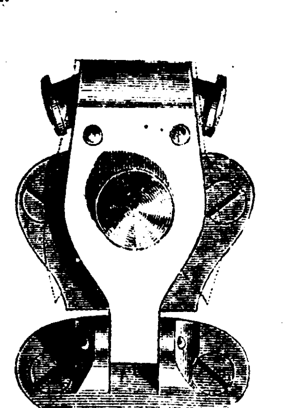
Having thus defined in shape for further consideration the one point of difference which existed, the president endeavored to find out upon what points all were agreed. These were substantially as follows.

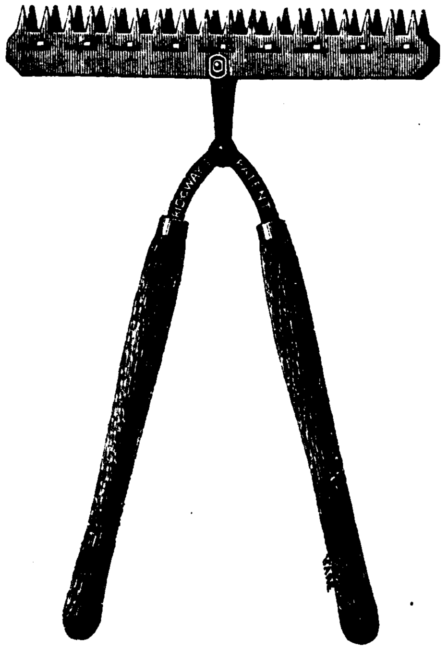
1. Good materials, especially the use of soil pipes of sufficient weight and free from holes.
2. Good workmanship, insuring tight joints.
3. The absence of traps in vertical lines of soil pipe.
4. The extension of all soil pipes to and above roofs, and the venting of every trap independent of the soil-pipe ventilation.
5. Giving all safe wastes, overflow pipes and refrigerators drip waste outlets wholly disconnected from the waste-pipe system and sewer.
6. Suitable protection for sewer pipes against frost.
7. So arranging soil and waste pipes that they shall be accessible from end to end.
8. Adequate trapping of all waste pipes under fixtures.
9. The discouragement of dependence upon deodorizers and disinfectants as correctives of bad drainage.
10. The prohibition of pan closets and all forms of closets having an air space within them which is not or cannot be ventilated.

Some, and perhaps all, of these conditions are likely to be insisted upon in houses which the law places under the jurisdiction of the board. The question of house-drain traps seems to have been left open for further consideration by the board. It is not likely that the fact of their objectionableness from a mechanical standpoint will be further doubted by the commissioners; but the question of their hygienic value in checking the spread of contagion through sewers receiving the discharges of typhoid fever patients and disease germs in other forms, is one which admits of further investigation, which we hope the commissioners will give it, determining, at the same time, what weight should be given to the suggestion that house drain traps are likely to increase the danger of spreading contagion among the several families in the house where contagious diseases appear. We hope the commissioners will determine these points, so far as possible, from actual observation, and not by quotation from English authors. Notwithstanding the fact that for some thirty years sanitary science has been more or less carefully studied in England, plumbing as practised in this country has been, and still is, incomparably superior to that in Great Britain. There are but few absurd notions connected with house drainage which cannot be sustained by unlimited quotations from English writers of reputation. For example, a few years ago some eminent "authority" found fault with the plan of placing water closets in dwellings and suggested the desirability of cutting them off from the living and sleeping rooms. The next book which appeared carried this idea further; the next further still, until the crowning triumph of theoretical sanitary engineering was reached by an "eminent" author who seriously advocated a Parliamentary enactment requiring water-closets to be placed in towers built wholly separate from houses, and reached from the several floors by bridges with open sides. We notice the same progressive tendency among English writers dealing with this question of trapped and disconnected house drains. For some years this idea of broken connections with sewers and cesspools has been a popular one in England, and a great deal of ingenuity has been expended in developing it. The theoretical sanitarians long ago learned from practical men to distrust simple traps in house drains, and in most of the later works absolute disconnection is advocated—the house drain emptying into some kind of vessel open at the top, and this discharging to the sewer by a pipe dipping below the constant water level. Those who have studied and done good work according to the best American practice, know perfectly well that such precautions are not essential to good house drainage, and that better results are attainable by cheaper and simpler methods. While conceding the great and permanent value of English sanitary literature, we can say with confidence that the great bulk of it has very little practical value for the American specialist in the mechanics of hygiene. From a library which includes nearly all the standard and much of the current English literature of sanitary science, we could pick out very little relating to house drainage which would be of use to the intelligent American plumber seeking information as to improved methods and materials. The reading would repay the effort, but it will be found to yield on these practical topics a great deal of sack to very little bread.

ADKINS' PATENT SASH FASTENER.

A new brass sash fastener, as shown in the accompanying engraving, has been brought out by Messrs E. Bach & Co., of Coleshill street, Birmingham. It is on the automatic principle, that is to say, self-locking, very strong and effective. The fastener is closed by a simple pull-down movement of the finger, when a pair of side spring clips of beeswing shape, engage in the slots on each side of a stud or pivot, and instantaneously lock it. The fastener is as readily opened by the finger and thumb. This patent sash fastener cannot be opened with a knife or other implement from the outside, and the sash is held sufficiently tight to prevent rattling or vibration of the window. The arrangement is simplicity itself.





NEW PATENT GRASS-CUTTING MACHINE.

Mr. A. Ridgeway, patentee and manufacturer of improved horse clippers, sheep shears, &c., of Macclesfield, has recently brought out a new patent grass-cutting machine, which we here illustrate as a novelty. This is a new application of the principle of the horse and hedge clippers, and it supplies a ready and inexpensive means of cutting and trimming grass-plots and lawns, edgings, and borders, which have always been inaccessible to the revolving cutters of the ordinary lawn mowing machine. The patentee claims that his new grass-cutter is much less costly than any lawn mower; that it is simple in construction, easily worked, and not readily liable to get out of order; and when dull by long use, it may be quickly and easily sharpened by an ordinary saw file. We have submitted this new implement to some practical tests, and have found that it can be worked in places and situations where it has heretofore been impossible by the aid of any machine to cut the grass rapidly and well. It is a most valuable tool in the hands of the tidy gardener, since it can be used for trimming better and more quickly the edges of garden walks or lawns, flower beds or borders, than any instrument yet used for the purpose. On old and neglected lawns, where the grass has become rough and dead, the new cutting machine will do less rapid and effective work; and it will either leave the grass on the ground to serve as a mulch, or the implement may be used as a rake for collecting it prior to removal. The machine is sold at a low price.

Safety From Drowning.—The *Sheffield Telegraph* says that the Rev. W. Cowell Brown, Wesleyan minister, of Sheffield, has patented an invention which appears to be a simple and practical means of lessening the number of deaths by drowning. A chemical preparation is inserted in a portion of the coat, waistcoat, or dress. It does not add to the weight or in any way alter the appearance of the garment. The preparation is inserted between the lining and the cloth; in the case of a coat, it is placed on each side of the breast and up the back. The moment a man touches the water the coat inflates and he cannot keep his head under the waves. The invention was practically tested at the swimming-bath of the Sheffield Bath Company, recently. The inventor states that his apparatus, which would simply form an additional lining inserted in a portion of the garment, would sustain a person in the water as long as he could possibly endure the exposure. For 40 or 50 hours it would be effective for its purpose. In the event of a person losing consciousness, the lining in the back would form a kind of bed, and that in the breast a pair of pillows, against which his head would rest.

PORTABLE BOOK-CASE.

I have not yet had an opportunity of seeing or reading a description of the "American portable book-case," but I beg leave to show a book-case which, for portability, will, I think, commend itself to those requiring such a thing. In the annexed sketch, fig, 1, is a front view of the book-case; fig. 2, the end, or gable. Fig. 1 is shown extended ready for the books, and fig. 3 shows the book-case folded up ready for removal, all the parts being contained inside in the order to be described. Fig. 4 is a section of fig. 3 at A. B, and shows the various pieces composing the article closely packed together—the whole being in fact next to a solid. Referring to fig. 1, it will be seen that the article consists of two gables with haffits in front, a top, a bottom, two shelves, a back, and a baluster railing over the front.

The following is a short description of its construction:—The two gables are 4 ft. long over all and 12 in. broad; They may be a plain board or panelled as in fig. 2; they have a haffit on the front of each, 3½ in. broad and 1 in. thick and a haffit also on the back of each, 2½ in. broad and ⅝ in. thick. Crosspieces are dovetailed into the bottom of the haffits, back and front, of the same breadth as front haffits, less the thickness of gables; corresponding crosspieces are mortised into the haffits at top, which convert the gables into shallow boxes or trays. The top board of the book-case is hinged at one end underneath the crosspiece, and folds down into that gable, allowing sufficient space behind it to contain one of the shelves, and the bottom board or shelf is hinged to the crosspiece at the bottom of the other gable in the same manner and allowing the other shelf to lie behind it, the two shelves and the top and bottom are disposed of, lying close against the inside of each gable: and there is still 2½ in. of space left to contain the back, and assuming the book-case to be 3 ft. 6 in. broad, the back will consist of four divisions, a little more than 9 in. broad each, and these are hinged together in the manner shown in fig. 5, which is a cross section, showing the article partly folded up.

FIG 1

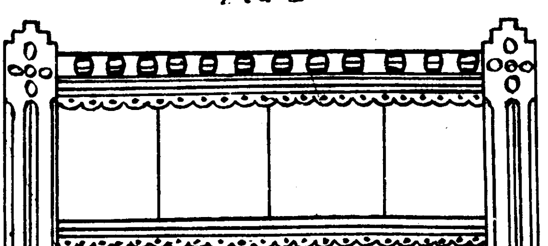


FIG 5

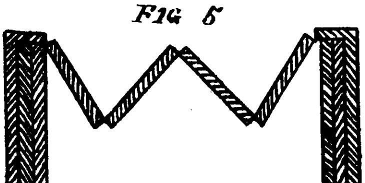


FIG 6

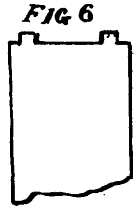


FIG 2

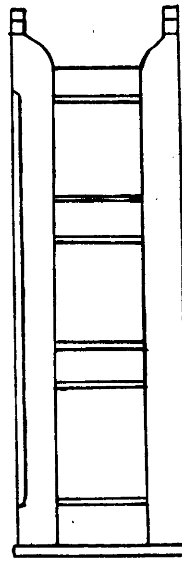


FIG 3

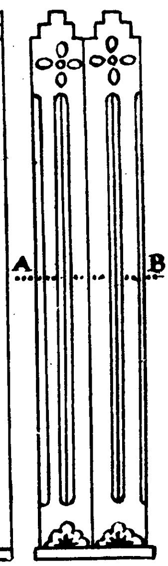


FIG 4

The four pieces composing the back are hinged to each other, and the outer ones hinged to the back haffiits attached to the gables. When fig. 5 is entirely closed up, it has the appearance of fig. 4, and as the back pieces are about 2½ in. narrower than the shelves, a space is left in front which contains the baluster railing. In fig. 1 this railing is held in its place by the two rails being let into the edge of the haffits by hollow mortices. The two shelves are held in place in the gables by short tenons, as in fig. 6, corresponding holes being made in the gables to receive them.

Now, this book-case may be packed or unpacked in a very few minutes. When folded up, as in fig. 4, it is held together by hooks and eyes, top and bottom, and the manner of getting it together for use is this: Laying the parcel with the back haffits on the floor, the hooks are undone, and the gables pulled asunder till the back is quite extended, then the bottom is turned over to its opposite gable, where they are fastened by passing a 1½ in. screw nail through the crosspiece into each of them, but this only after the two shelves have been fitted into their holes in the gables, and the baluster rail fitted in the same manner. The two screws being in, two other screws are passed through the back near the centre joint into each shelf and this completes the job. The back is made of ⅝ in. wood, the gables and shelves ⅞ in. wood. The front of the haffits are chamfered and channeled down the centre. The shelves have ornamental leather—common to book-cases without doors. Fig. 6, as may be seen, is but a parcel of wood 4 ft. by 12 in. by 7 in. and may be shouldered by a boy. For a larger book-case of this description, having more shelves to stow away, an increased recess in the gables would have to be allowed.—A. CABE *in Design and Work.*

NEW DYE FROM POPLAR WOOD.

Under the name of "Ericine," a fine golden-yellow dye is now prepared from the young wood of various poplars, as well as from the woody portions of heather, the botanical name of the latter (*Erica vulg.*) having apparently suggested that of the dye. Young branches and shoots of poplar are cut off, crushed, and brayed, and then boiled in alum-water, the proportions allowed being 10 pounds of wood and 1 pound of powdered alum to each 3 gallons of water. The liquor is boiled from about twenty minutes to half an hour, and then filtered. In cooling it thickens and clears, throwing down a greenish-yellow deposit of resinous matter. When sufficiently clear, the liquor is again filtered, and then left exposed to the air for three or four days or more, according to the weather and the state of the atmosphere. It quickly oxidizes under the action of the light and air, and assumes a rich golden tint. In this state it can be used for dipping fabrics of all descriptions. For yellow and orange-yellow shades, it is used alone; mixed with Prussian blue, it gives green; with oak bark, brown and tan; with cochineal, etc., orange and scarlet shades. Or the coloring matter can be precipitated, and then makes a fine and perfectly innocuous yellow body-color for wall-hangings and such like purposes.

Scientific Items.

PROGRESS IN SCIENCE AND THE ARTS.

TECHNICAL BREVITIES,—Question has been raised, by reason of the unfavorable terminatian of a certain case, concerning the safety of bromide of ethyl, the *new analsthetic;* but the great preponderance of evidence is favorable to the view of its advocates, that the medical profession have in it an anæsthetic superior to both ether or chloroform. *A reform much needed* in the matter of disposing of sewage has been introduced at Brighton Beach, by the adoption of an effective system of separating the solid from the liquid portion of the same, purifying the latter, and converting the former into a commercial fertilizer. The sooner our seaside resorts generally follow this example, the better will it be for their reputation as health resorts; for, from what is known of the utter neglect of the subject of drainage at many of these places, their freedom from filth-diseases is one of the standing marvels.

—The report of the British Consul-General at Bangkok, lately published, contains the first detailed account of the remarkable discovery made in 1879 of *valuable sapphire mines* in that part of Siam. The portion of the *Saint-Gothard Tunnel* which has given so much trouble on account of the falling in of the roof, it is now thought has been permanently fixed. The cause we have previously described. It has given so much trouble that at one time it was seriously proposed to allow it to collapse, and make a *detour* which would avoid the objectionable "stretch," altogether. The expedient was lately adopted, however, of rebuilding the supporting masonry in rings of solid granite; and thus far, the experiment has been successful. The rings are each four meters long, so that, in the event of any one of them giving way, the others will not be affected. The utmost care is taken in the work; no imperfect stones are allowed to be used; the masonry is perfect, and the walls are of extraordinary thickness—in the parts most exposed to pressure, not less than 10 feet thick.

—The curious substance known as *China moss* has a peculiar constituent called gelose, which has the property of absorbing and solidifying into a colorless and diaphanous jelly, five hundred times its weight of water, and is capable of forming ten times as much jelly by weight as the best animal gelatine.

—The second specimen of the fossil reptilian bird, known as the *archæopteryx*, found in the lithographic slates of Solenhofen, was purchased for five thousand dollars by Herr Siemens, of Berlin, to prevent it from coming to this country. It is now in Berlin, on deposit in the Geological Museum, with the expectation that it will be purchased by the government.

—In a recent lecture by Professor Flower, before the Royal College of Surgeons in London, the question of the *origin of man on the American continent* was discussed at some length. The statement was made that, "taking all circumstances into consideration, it is quite as likely that Asiatic man may have been derived from America as the reverse; or both may have had their source in a common centre in some region of the earth now covered by the sea.

—The prevalence of *oil-tank fires* this year, chiefly caused by lightning has caused very general remark, The *Scientific American* to account for the special liability of such tanks to be fired by lightning, advances the theory that from every such tank there is a constant escape of light hydrocarbon vapor, which forms a permanent cloud or column, rising to a great height above the tanks. This vapor is a conductor, which the lightning naturally follows, and which attracts it. This theory is ingenious, but fails to account for the immunity which iron-top tanks enjoy from destruction, and which the *Iron Age* affirms to be the fact, "from positive knowledge of all tank-fires that have been caused by lightning during the past seven years."

—Mr. Bower's plan for *protecting iron against oxidation* by treating the cleansed surfaces in a chamber of suitable size with heated air, and subsequently reducing any red oxide that may have been formed by the introduction of reducing gases, is reported in London *Iron* to have been developed on the commercial scale very satisfactorily. It is said to have become a dangerous rival to the process of Barff, who employs superheated steam for the same purpose.

—Some genius has made the interesting calculation that 72,540,000 packages, or 18,740,800,000 single pins, are manufactured yearly in the United States, representing 468 pins for every indivdual of our population. He makes the questionable statement, likewise, that fifty years ago it took one man a minute to make 14 pins, while to-day a single workman will make 14,000 in the same time.

The assertion is made that the authorities of the New York Central Railroad intend to add to all their locomotive engines an attachment for *arresting sparks and cinders*, to prevent their escape from the smoke-stack.

—The prosperity of the *Pennsylvania Railroad Company* has been remarkable. The increase in its earnings has been at the rate of four or five millions per year, and for the first four months of the present year was at the rate of six millions and a half for all its lines.

—From a small beginning in 1832, with an appropriation of $25,000, the *United States Coast and Geodetic Survey* has become an establishment of great importance, employing 300 men and 14 vessels, with an annual appropriation of over $500,000.

MR. LAW'S REPORT ON THE TAY BRIDGE.

The Commissioners to investigate the cause of the Tay bridge disaster, Messrs, Rothery, Barlow and Yolland, employed Mr. Law, M. I. C. E., to examine the bridge after the fall of a portion of it to make a report thereon, which could be used as evidence on the trial. As a result he submits a long report, in which his conclusions summed up would make the statement appear as follows: The base of the pier was too narrow, occasioning a very great strain upon the struts and ties, that the angles at which the latter were disposed, and the mode of connecting to the columns were such as to render them of little or no use, and that the other imperfections which have been pointed out, lessened the power of the columns to resist a crushing strain; and further that the yielding of the struts and the ties was the immediate cause of the disaster. Some of the other imperfections alluded to were, first, the defective mode of connecting the columns at the flange joints, the bolts being one-eighth inch less in diameter than the hole, and the flanges being separated in some cases as much as three-fourths of an inch. The concrete was also found to be bad, on account of its inequality. The mode of attaching the ties to the columns by means of lugs was evidently insufficient, as in almost every instance the lugs have been torn away.

THE ENGLISH CHANNEL TUNNEL.—It is asserted that withn 18 months two and a half miles of the channel tunnel betwen England and France will have been excavated, and that the work will be completed in four years, probably by boring from each end. There are evidently, however, contingencies, such as a break in the rock, which may destroy the whole enterprise. Meantime another bold scheme for crossing the channel contemplates a line of steel tubes 16 ft. in diameter, ballasted so as to make it weigh one and a quarter tons to a foot less than the water displaced, and held at a depth of 35 ft. below the surface (so as not to impede navigation) by being anchored by chains or caissons sunk to the bottom. Through this floating tunnel of 20 miles or so it is proposed that railway trains shall pass. The scheme appeals too strongly to credulity.

REDUCING POWER OF GRAPE-SUGAR.—Professor Böttger highly recommends the use of glucose in alkaline solution for the reduction of salts or silver, affirming that there is no procedure that is so convenient or which gives surer results. He proceeds in the following manner: Chloride of silver, freshly precipitated and well washed, is suspended in a suitable quantity of a diluted solution of caustic soda. To this a small quantity of glucose is added, when, on boiling for a few minutes, a complete reduction takes place. The metal, if collected, washed, and slightly calcined, may be obtained in form of a spongy mass of dull white color. The same method yields a very active platinum black.

THE DISSOCIATION OF IODINE.—Prof. Victor Mayer reported to the German Chemical Society of Berlin, at its last meeting, that he had succeeded in determining the vapor-density of iodine at a considerably higher temperature than before, and that he had obtained values closely approximating to those required on the assumption that the gas under the circumstances of the experiment consisted of monatomic iodine molecules. If possible, he proposes to extend his observations to still higher temperatures, and for this purpose will employ the lately-described oil-furnace of Deville and Troost, which is capable of fusing porcelain.

AN extensive bed of shell marl has been discovered near Orillia, Ont.

PROSPERITY OF THE EMIGRANTS.

The emigration from suffering Europe to the United States, is greater now than it ever was before. During the first four months of this year the unparalleled number of over 60,000 emigrants arrived. The proportions in regard to nationality are as follows: for every 100 Germans there were 71 Irish, 46 English, 30 Swedes, 3 Norwegians, 5 Danes, 6 Hollanders, 3 Belgians, 15 Swiss, 5 French, 18 Italians, 7 Russians, 3 Bohemians and 1 Greek.

Those who understand a trade find work at once; many having been provided before their arrival, while the applications of manufacturers and builders are so numerous that the supply of hands, large as it is, is not equal to the demand. The trades which require labor and have thus far not been sufficiently provided for are quarryman, stonecutters, puddlers, moulders, and all branches of iron manufacture. On the first of May more than 100 applications were on file at Castle Garden from manufacturers which had not been supplied. The application of parties desiring German or Swedish servant girls, number by the thousand.

That we are great gainers by such an influx, is evident from the fact that only that element of a people emigrates, in which there is the pluck and energy to do so, and who have also the means to pay their way to this country, and usually more, to a greater or lesser degree; while those who do not work but live from the product of labor of others, and, therefore, are useless in society, being mere consumers and not producers, stay at home and have to support that other class, who are unable or unwilling to work and therefore too poor to emigrate.

DESIGN AND WORK IN CABINET FURNITURE.

Our present illustration is a piece of parlor furniture called a chiffoniere. It is used for many purposes, as the wants of a family may require, including a stand for a small selection of books. The article is intended to be made of mahogany, and consists of a carcase, enclosed by two doors, and having a drawer the full length between the blocks over the carved trusses, and over this cascase is an upright back with two shelves for books, supported by small turned pillars. This article is at present shown as a piece of furniture suitable to the cottage or a tradesman's dwelling, and one which the ordinary intelligent and handy amateur might readily construct; and for the benefit of such as may enter upon the task, I will describe its construction in detail.

It consists, first of all, of a base 4½ inches deep, of ⅞ wood, dovetailed together at the corners, with the blocks in front, 3½ inches in breadth, 2½ inches thick, rubbed on afterwards. If veneered, the front of the base between the blocks would be veneered, and the two blocks on the inner side also veneered. These, when dry, would be cleaned off and the blocks rubbed on; then the ends of the base and the blocks would be covered each with one piece of veneer, and after this the front of the blocks with veneer of richer quality, such as on front of base. Lastly the upper edges of the base would be veneered along with the ends of the blocks—the front of the base being previously filled in with a piece of pine 2 inches broad and ⅞ inches thick. This base is 4 ft. long and 22 in. Over the blocks, and consequently 19½ inches in the middle. Now a carcase is made, having two gables, either solid or veneered, 2 ft. 8 inches long and 18 inches broad. Those have a bottom ⅞ thick and a shelf or forelegs underneath the drawer and over the doors; this foreedge is hid, however, by the drawer front projecting downward to a level with the bottom of the end blocks. These blocks are treated like those on the base, and rubbed on after the carcase is put together. The bottom referred to is dovetailed into the ends of the gables, and the shelf under the drawer let into the gables by a raggle dovetail. The top of the gables are let into a 1½ top by short tenons or pins. This top being veneered on the edges. and covered with one piece on the top. The drawer front is 5 inches deep, and has a torus head along the under edge. This carcase has a ⅝ inch lining back cheeked into gables. Midway in the height, inside this carcase, is a shelf resting on lillets, screwed to the gables.

Over this carcase is an upright back of 1 inch framing, with two long panels between the shelves. The 2 panels are let in from the back, and the framing in front is without moulding or champer of any sort. The two shelves are of 1 inch wood, either solid or veneered both sides and edges; the lower one is fixed to the back with screws from behind, and the upper one is fixed with screws passing through it into the upper edge of the back. The shelves are supported by slender pillars of 1½ inch wood turned, excepting bases and tops. Behind the bases are short railings abutting on the back of balusters 2 inches long and ⅝ inch thick, and underneath the shelves are corner brackets of open fretwork, fixed behind the pillars. Over the other shelf is a coping or railing of ⅝ inch fretwork 3 inches deep, and raised to 6 inches in the centre. This is fixed on with short dowels. It may be mentioned that the doors on the carcase are 1 inch thick and panels ½ inch, with double ogee moulding planted on the face. The carved trusses are 2½ inches broad on the face, and have behind them a thin pilaster, the full length of the doors. It may be mentioned that this article is French polished, and that piecemeal, the panels, trusses, brackets, pillars, frames, etc., being polished before fitting in their places. The carving and fret cutting are done by tradesmen, apart altogether from the cabinet maker.—A. Cabe, in *Design and Work.*

DESIGN AND WORK IN CABINET FURNITURE.

I have this week to bring to the notice of readers a form of dining table which is coming into favor, as it ought to do. The ordinary parlor table is usually made circular or oval, with a massive pillar and block, supported by three or sometimes four carved claws, projecting from the bottom of the pillar. This form of table is at best an awkward affair, as when in a position for use it takes up a great deal of floor space, and when turned up on an edge, and placed against the wall like a target it is quite useless, and certainly not ornamental, and if not well made at first, the claws are forever getting loose, and threatening a catastrophe.

The table here shown is a vast improvement upon the former both in appearance and utility. Fig. 1. is a perspective view, with the leaves hanging down. In this position the table is but 20 inches broad. It may stand against the wall, taking little room, and is still of much use as a piece of furniture.

Fig. 2, shows the underside of the table, with the leaves spread out, and the dotted lines show the inner feet turned out in the position to support these leaves.

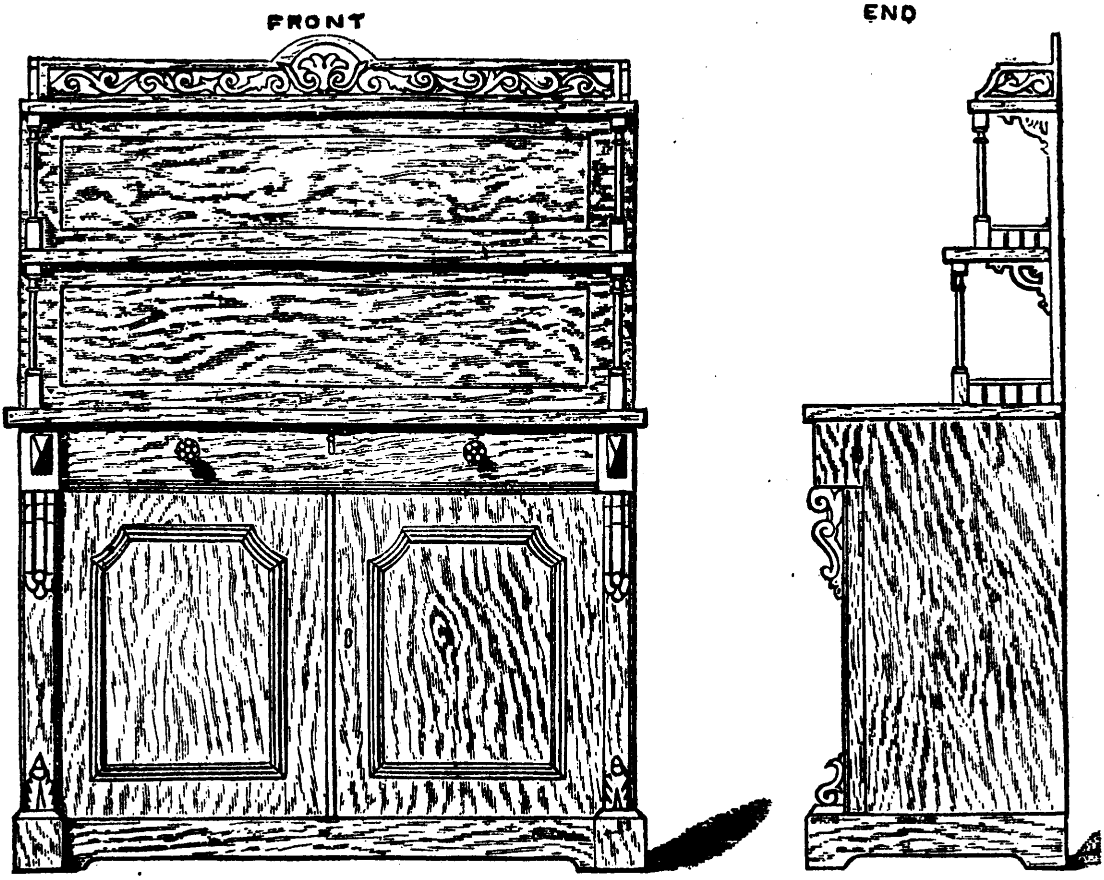
It will be observed there are eight legs, all turned, excepting the square parts at the lower rails (we call them stretchers). Four of these legs are in the corners of the frame, and remain fixed; the other four are attached to short rails top and bottom, and being hinged, turn outwards. These legs are 2½ in. square, and the rails to which the top is joined are 4½ in. broad and 1¼ in. thick. The end rails, A A, are let into the corner feet; the long rails, B B, are simply placed behind the corner jnt, and screwed to them. Then the short rails, C C, are let into the corner feet and screwed to the long rails, B B which make a thoroughly secure job. The four inner feet are mortised to rails the same in girth as the rails C C, and are hinged to them at the dotted lines. The stretchers are 2 in. broad and ⅞ in. thick. The long ones are double, and screwed together where they enter the legs, and are hinged at a point exactly vertical with rails above. This arrangement will be understood at a glance by the practical reader.

The top of this table is of ⅞ in. wood, the central part being 4 ft. long and 13 in. broad inside the legs, and is fastened to the top from the inside with screws. The leaves are joined to the centre by the method known as the Pembroke table joint, which shows a quarto-round with two listels, and the hinges underneath are quite invisible. This joint is very common on the older tables. It is a very nice job to do well, and it is a notorious fact that very many of our modern cabinet-makers are entirely ignorant of this method of hinging.

The corners of the top are cut off at an angle of 45 deg., and the cut is 12 in. long. The rails are hinged to the frame with iron hinges known as back flaps, and the stretchers with brass hinges of the same description, and sunk flush.

This table may be made in mahogany or American walnut, and is a pretty, substantial, and durable piece of furniture. It may be used with both leaves down, one up, or both up, and is altogether better adapted for use as a parlor dining table than anything yet contrived for that purpose. If made as it ought to be, it will last for an age without liability of a breakdown. I have made small card tables in American walnut of same design. —A. Cabe *in Design and Work.*

To Clean Wall Paper.—Soiled wall-paper may be made to look almost as well as new, in most cases by the following expedient: Take about two quarts of wheat bran, tie it up in coarse flannel and rub it over the paper. It will clean the whole paper of almost all descriptions of dirt and spots better than any other means that can be used. Some use bread, but dry bran is better.



DESIGN FOR A CHIFFONIERE,

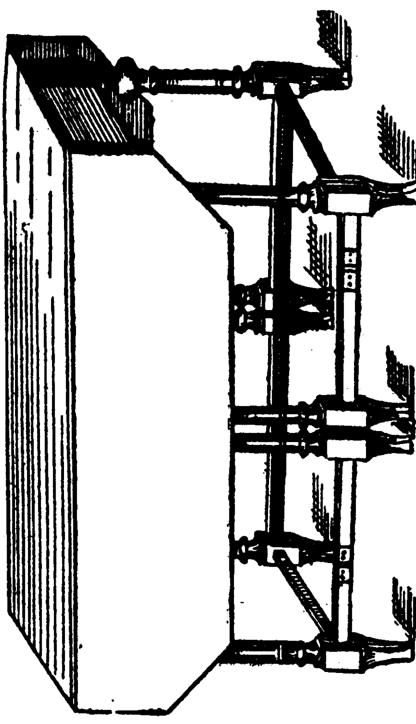


FIG. 1.

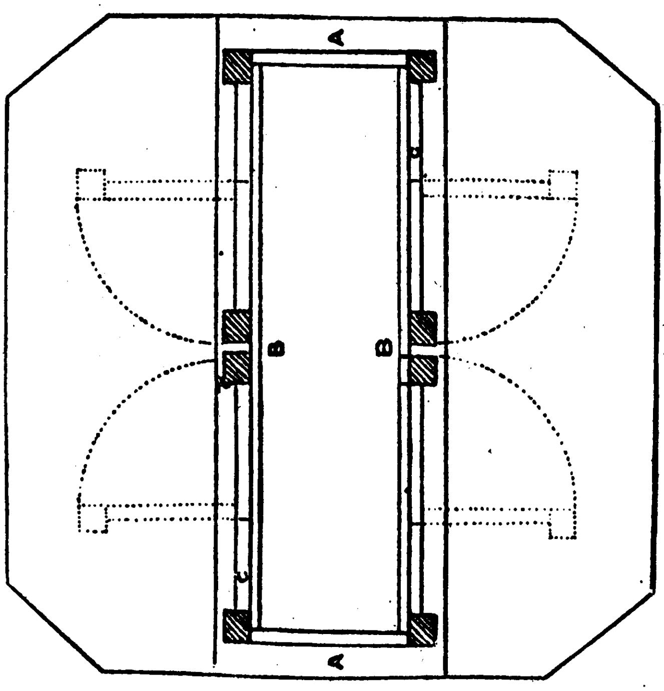


FIG. 2.
DESIGN FOR DINING TABLE.

BEET ROOT MANUFACTURE, FARM AND DISTILLERY OF "FERME DE LA BRICHE."
Langeis, Department of Inde et Loire, France.—(*See page 279.*)

THE MANUFACTURE OF RESIN AND TURPENTINE.

From Wilmington, N. C., southward, and nearly all the way to Florida, the pitch-pine trees, with their blazed sides, attract the attention of the traveller. The lands for long stretches are almost worthless, and the only industry, beyond small patches for corn or cotton, is the "boxing" of the pitch-pine trees for the gum, as it is called, and the manufacture of turpentine and resin. There are several kinds of pine trees, including the white, spruce, yellow, Roumany, and pitch pine. The latter is the only valuable one for boxing, and differs a little from the yellow pine, with which it is sometimes confounded at the North. The owners of these pine lands generally lease the "privilege" for the business, and receive about $125 for a crop, which consists of 10,000 "boxes." The boxes are cavities cut into the tree near the ground, in such a way as to hold about a quart, and from one to four boxes are cut in each tree, the number depending upon its size. One man can attend to and gather the crop of 10,000 boxes during the season, which lasts from March to September. About three quarts of pitch or gum is the average production of each box; but to secure this amount, the bark of the tree above the box must be hacked away a little every fortnight. Doing this so often, and for successive seasons, removes the bark as high as can easily be reached, while the quality of the gum constantly decreases, in that it yields less spirit, as the turpentine is called, and then the trees are abandoned. The gum is scraped out of the boxes with a sort of wooden spoon, and at the close of the season, after the pitch on the exposed surface of the tree has become hard, it is removed by scraping, and is only good for resin, producing no spirit.

The gum sells for $1.50 a barrel to the distillers. From 16 barrels of the crude gum, which is about the average capacity of the stills, 80 gallons of turpentine and 10 barrels of resin are made. The resin sells for from $1.40 to $5 per barrel, according to quality, and just about pays for cost of gum and distilling, leaving the spirit, which sells for 40 cents a gallon, as the profit of the business. Immense quantities of resin await shipment at the stations along the line, and the pleasant odor enters the car windows as you are whirled along.

After the trees are unfit for further boxing, and are not suitable for lumber, they are sometimes used to manufacture tar; but the business is not very profitable, and is only done by large companies, who can thus use their surplus labor. The trees are cut up into wood, which is piled in a hole in the ground and covered with earth, and then burned the same as charcoal is burned elsewhere. The heat sweats out the gum, which, uniting with the smoke, runs off through a spout provided for the purpose. A cord of wood will make two barrels of tar, which sells for $1.50 per barrel, and costs 37½ cents to make. The charcoal is then sold for cooking purposes.

ANOTHER GREAT ENGINEERING WORK COMPLETED.

An English exchange gives the following account of the completion of one of the most stupendous works of engineering skill and enterprise of ancient or modern times. We have been in the habit of crediting the new world with some of the most daring and enterprising improvements, but we can boast of nothing that surpasses this. Says the exchange referred to: "Somewhere about 3,000 workmen, 600 or 700 wagons, 17 or 18 locomotive engines, 3 steam "navvies," and a great quantity of minor machinery of various kinds have been engaged since 1875 at the southeast end of London in a work, compared with which the building of the pyramids—with modern appliances—would have been no very signal feat. Hitherto the one entrance to the Victoria docks from the Thames had been at Blackwall point, but now there is a dock capable of receiving all vessels, no matter what they might be. Three and a half miles of walls have been built, enclosing 90 acres of water. These "walls" are 40 ft. high, 5 ft. thick at the top and 18 ft. thick at the bottom, the whole of this enormous mass being composed of solid concrete, for which 80,000 tons of Portland cement have been used. Some 4,000,000 cubic ft. of earth have been dug out. It may assist the imagination somewhat to state that if it were filled into carts, the vehicles would form an unbroken line 7,000 miles long. The excavations have gone through submerged forests; and, among other curiosities dug out, have been a reindeer's horn, a Roman vase, and what is supposed to be an ancient British canoe, carved out of solid oak. The latter is now in the British museum. The new entrance below Woolwich will save about three and a half miles of river navigation, which, in the case of vessels of heavy draft, is, of course, a matter of very great importance."

Miscellaneous.

LIGHTING ROOMS.—M. Javal, in a paper on public and private lighting, considered from the aspect of ocular hygeine (*Revue Scientifique*, Oct. 18, 1879, p 361), treats of artificial lighting. He says that a chandelier carrying a million of wax lights would not give an amount of light equal to sunlight. Even in a room lit up in an unusually brilliant manner the pupils are much more dilated than in full daylight; and this dilatation explains the fatigue to the eyes produced by artificial light. Therefore, there is never too much, in fact never enough, artificial light, and prejudices without any just foundation are prevalent on this point. M. Javal recommends to persons suffering from certain optic defects, and who cannot work in the evening, two large lamps, which would obviate the fatigue of reading. Artificial light, also, excepting the electric and magnesium lights, contain much fewer chemical rays than daylight. All artificial spectra are very dull on the most refracted side; the chemical rays, the violets and the blues, there show a very low intensity. M. Bouchardat (*Revue Scientifique*, August 16, 1879, p. 148) has shown the dangers of violet and deep violet rays, on the authority of M. Regnauld's important work on the fluorescence of the media of the eye. The conclusion to be derived is that the flame light being poorer in chemical rays than sunlight, should be preferred by workers. In fact M. Javal quotes the instance of a member of the Institute, whose fatigued vision would scarcely tolerate daylight, and who shut his shutters, and lighted his lamp, in order to work. M. Javal recommended him to work in daylight with yellow spectacles to destroy the chemical rays. Artificial light, on the other hand considerably dilates the pupil, and renders the chromatism of the eye more sensitive, which is the reason that the light of day is to be preferred. The electric light is injurious, in a certain point of view; it contains a large quantity of chemical rays, which it would be easy to neutralize by giving a yellow tint to the globes. Nevertheless, neither the public, nor the experts, have complained up to the present time, of the electric light; inconveniences only arise when the eyes are too long a time on a too powerful electric light. It is, therefore, advisable not to look too long at electric lights, and when this becomes a habit, the opacity of the globes now in use can be diminished. In fine all our systems of artificial light are insufficient; there is, then, no necessity to fear excess of light, since, on the contrary, artificial light is less penetrating than daylight. Gas, therefore, does not destroy the eyesight, it is the wavering and flickering of the flame, when there is neither globe nor chimney, which fatigues the sight; gaslight, with a burner protected by a globe, is excellent for it. M. Javal may well, then, say, with dying Goethe—"Light more Light!"—*Sanitary Record.*

EUCALYPTUS TREE AND FEVER.—In a late number of *Nature* some very positive statements are made as to the value of the eucalyptus or blue-gum trees of Tasmania in destroying fevers in marshy districts. The testimony in support of this power, it says, is most convincing. In marshy districts near eucalpytus forests, fever seems to be unknown, and in parts of Corsica and Algeria, where the tree has been planted for the sake of its reputed virtues, endemic fevers have been stamped out. M. Gimbert, in a report to the French Academy, instanced the case of a farm situated in a pestilential district about twenty miles from Algiers, where by planting a number of trees the character of the atmosphere was entirely changed. Similar testimony comes from Holland, the south of France, Italy, California, and many other parts of the world as to the febrifugal attributes of this tree. In no case is the evidence more convincing than in that of Algeria, as related by Dr. Santra, and, quite recently, by Consul Playfair. Large tracts of land have been transformed by the agency of the "fever-destroying tree," as it has come to be called, and wherever it is cultivated fevers are found to decrease in frequency and intensity. Fewer districts in Europe have a more evil reputation than the Campagna as a veritable hot-bed of pestilential fever, and people who know the country around Rome may remember the monastery at Tre Fontane, on the spot, as tradition tells, that St. Paul met his death. Life in this monastery meant death to the monks, but since the eucalyptus has been planted in the cloisters, fever has disappeared and the place has become inhabitable.

RE-BRONZING ORNAMENTS.—The common method of imitating bronze on plaster casts, wood, metal, etc., is to paint first with one coat of greenish brown, let it quite dry, and then varnish with bronze powder that has been ground on a marble slab, with gum water or honey. This gives the metallic appearance sought for. Tin that is first, ground, then sifted very fine, and mixed with a clear solution of isinglass, will also have the same effect. It is applied to the ornaments with a brush. If a dead surface is desired nothing more than the foregoing is needed ; but if a brilliant facing is wished, quick friction will produce a burnish. About ½ oz. sal ammoniac, ½ oz. common salt, 1 pint vinegar, and 1 oz. spirit of hartshorn, all mixed together will give the bluish green oxydised hue that is generally desired. This wash must be put over the ornaments after they have been painted and varnished with the metal powder preparation before indicated, and it should be done in a sunny situation, rubbed thoroughly, left in the sun for a day or two, and then another wash given if the first has not produced enough tint. Sal ammoniac or ammonia water with vinegar, skilfully placed on plain bronzes, will make them look oxydised.

Hints for Preserving Fruits.—A useful hint to cooks was given at a recent sanitary convention in Grand Rapids, Michigan. It was pointed out that by adding sugar to sour fruits, during the cooking process, the greater part of the cane sugar was converted by the aid of the acid into grape sugar, which does not possess half the sweetening power. By cooking the fruit first, and then adding the sugar to an agreeable sweetness, a very great deal of sugar might be saved. Raspberry, strawberry, and cherry syrups of the German pharmacopia have to be made by bruising the fruit and letting the marc and juice ferment, after which the juice is strained off and filtered. A better and safer way is to add at once to the freshly bruised fruits five to six per cent. of alcohol, to let the whole stand for some days, decant and filter. Lastly, boil up once to remove the greater part of the alcohol. Syrups made with juice prepared as above retain in a remarkable degree the odour and taste of the fresh fruits.

Lubricators.—The *Young Scientist* remarks : That efficiency of lathes, scroll saws, sewing machines, and even watches, often depend upon the judgment and care used in selecting a lubricator, and this choice is frequently ill made. Common kerosene oil is too often injudiciously used in place of a thicker or more bland oil, because the heat produced by friction rapidly vaporizes the oil and leaves the journal dry. Crude petroleum, for the same reason, is only fitted for very slowly revolving journals, such as water-wheels. For very heavy machinery, or for gearing, tallow and black lead, rubbed up together, is the best lubricant, and also the best for waggon and carriage axles during hot weather. For light running machinery sperm oil is the best ; good olive oil that has not become rancid and acid, is perhaps the second best, and for winter use lard oil is excellent, but is rather too drying to be a first-class lubricant. Castor oil is better for axles in the winter, and black lead with it is a help at any time.

How to Weld a Broken Spring Plate.—Get the length and then take the part of broken plate which is easiest to handle and upset it suitable for welding. Make a piece of iron five-eighths of an inch wide, quite thin at one edge, leaving the other about three-eighths of an inch thick, something like a razor blade. Take a welding heat on the part that has been upset and weld the iron across, having the thick end on the point of the plate. Scarf it for welding, upset the other part of plate and scarf it so that when welding the piece of iron comes between the two steels. In the first heat—it cannot be done in one—don't strike too hard at first, and thin down any thick edges of the scarfs. Take a second heat and the result will be, in the hands of an average smith, a good sound weld. If the steel is at all fiery do not attempt to weld it. Should there be a hole near the broken place, showing, on being heated, any sign of a flaw, make a new plate. The piece of iron welded between facilitates the welding, and also makes up for the length lost in jumping. —*London Coach-Builders' Journal.*

The Philosophy of Dyeing.—A French expert has recently been making some very interesting experiments upon animal and vegetable substances, with the view of ascertaining how coloring matter is taken up by the substances which are being subjected to the dyeing process. It was found that the action depended largely upon the capillarity of the fibre or other substance treated. Microscopical examination of infusorial earth showed that the coloring matter entered the capillary tubes of the infusoria, and attached itself to the inner surface of the walls. So with fibrous material. The more fully the capillary construction was developed, the more perfect is the capacity of the substance to receive colors. This fact will be found of special importance in the art of dyeing, and affords an explanation of the reason why some substances receive dyes more readily than others.—*Californian for September.*

Iron Paint.—A German paper mentions that a Herr Chr. Spangenberger has patented in Germany a paint composed of pulverized iron and linseed-oil varnish. It is intended for painting damp walls, kettles, outer walls, or, in short, any place or vessel exposed to the action of the open air and to the weather. Should the article to be painted be exposed to frequent changes of temperature, linseed-oil varnish and amber varnish should both be mixed with the paint intended for the first two coats, without the addition of any artificial drying medium. The first coat should be applied rather thin, the second a little thicker and the last in a rather fluid state. It is not necessary to free iron from rust, grease, etc., by means of acid before applying the paint, as superficial cleaning is sufficient. The paint is equally adapted as weather-proof coating for iron, wood and stone.

Infinitesimal Fibres.—The microscope shows a variation in the thickness of human hair from the 1·250th to the 1·600th part of an inch ; but, notwithstanding such fineness, it is a massive cable in comparison with some other fibres. Thus the thread of the silkworm is many times finer, being from the 1 700th to the 1·200th of an inch. This, however, is nothing to the slenderness of the spider's thread, which has been found in some instances to be more than 1·30,000th of an inch in diameter. The fibres yielded by the vegetable kingdom are also of astonishing minuteness. Thus every fibre of flax is found to be composed of a bundle of other fibrils which are about 1·2500th of an inch in diameter. Similar fibesr obtained from the pineapple plant have been ascertained to be no more than 1·500th or even 1·700th of an inch in diameter.

Mounting Oleographs.—Make your frame of wood, on which stretch your canvas (damp) ; lay the oleograph face downward, damp the back with cold water, using a sponge ; then paste the back, using rice flour paste, in which a few drops of oil of cloves have been dropped. Damp the canvas, then press the oleographs carefully in position, pressing out all air from centre, using a soft cloth ; then lay aside to dry. Care should be used to well paste the edges. When quite dry, varnish the oleograph with either copal, oak or hard white varnish, or for simplicity use the ordinary paper varnish, but you must be guided by your own judgment. Some oleographs require a dark varnish to show up the effect, others should be varnished as light as possible. We do not approve of glue, it is liable to crack.

Decorations,—Velvet cloth and lace have been so vulgarized for mantlepiece decoration, that the newest thing in this way is the old original marble or wood shelf, without ornament of any kind beyond carving and polish. But if "The Little Lady" must hide her mantleshelf on account of unsightliness, a shelf of highly polish ebonized wood, with a black fringe, fastened on with gilt nails, would look as artistic as anything. The newest material for drawing summer curtains are either écru yak lace or squares of guipure d'art, alternated with linen or coloured silk or satin, made up into curtains. Oatmeal cloth, unbleached huckaback or crash, with crewel embroidery borders of bright hues, are also pretty and substantial.

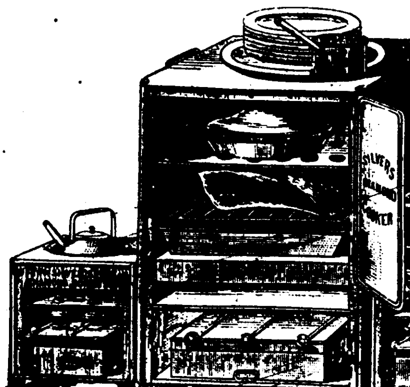
—To whiten walls scrape off all old whitewash, and wash the walls with a solution of two ounces of white vitriol to four gallons of water. Soak a quarter of a pound of white glue in water for twelve hours ; drain and place in a tin pail, cover with fresh water, and set the pail in a kettle of boiling water. When melted, stir into the glue eight pounds of whiting, and water enough to make a mixture as thick as common whitewash. Apply evenly with a good brush ; if the walls are very yellow, blue the water slightly by squeezing in it a flannel bag containing some powdered blue.

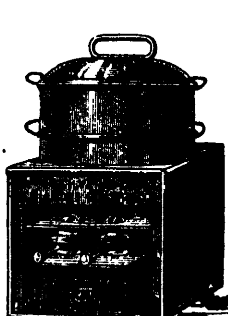
Dyeing Sheepskin Mats.—Boil 2 lbs. of logwood chips in one gallon soft water (rainwater preferred) for two hours ; while hot, add 1 oz. green copperas. Stir the whole until the mixture turns black, pour the hot liquor in a tub, in which steep the mats, moving them about so that each part receives the dye. The time allowed for steeping may be judged by circumstances, or until the mats are of the desired jet black. If not dark enough heat the liquor again, and give the mats another steeping. Hang on a line in open air to dry. By omitting the copperas the mats would be a dark red.

To Restore Rancid Oils.—Fixed oils may be deprived of rancidity by adding a small quantity of sweet spirits of nitre and shaking well, and afterward heating slightly till the odour of the spirit has disappeared.

SILVER'S DIAMOND LIGHT COOKER.

At this season of the year it is a great comfort and convenience to be able to dispense with large coal fires for cooking, with their concomitants of dust and smoke, constant supervision, and great cost. And yet there are many people who are not aware that this can actually be accomplished at less than half the cost and trouble, by the use of petroleum or common mineral oil, with "Silver's Diamond Light Cooker," manufactured by the Chimneyless Lamp Company, Birmingham. The annexed small illustration shows "Silver's Diamond Boiler," with kettle, a miniature breakfast stove, capable of boiling water, making coffee or tea, cooking chop or rasher, toasting bread, boiling eggs, &c., in a few minutes. This portable apparatus forms an indispensable adjunct to the domestic kit of any man who has to rise betimes and hurry away to catch the early morning train. This stove is made in several sizes, and with boiler and vegetable cooker, to boil water, steam potatoes, &c., and stew or fry. "Silver Diamond Cooker," No. 4, is of larger size, complete with meat dish and grid, kettle,





two steamers, and pan to stew or fry, suitable for cooking dinner or supper for a family. The oven is double cased and is completely separated from the burners, so that all idea of the oil imparting any objectionable flavour to the viands is effectually got rid of. By the arrangement of Silver's patent burners, the uniformity of the heat, and the mode of ventilation render attention to a joint in cooking quite unnecessary. "The Diamond Light Cooker" will roast joints, fowls, &c., equally as well as a coal fire, and bake bread or pastry most perfectly. One great merit of these cookers is that they are ready for cooking as soon as the burners are lighted, and in addition to that they have the advantage of being cheap, clean, and without smoke, smell, or nuisance. These stoves are all black leaded, thus getting rid of the objectionable black varnish so commonly used on articles of this kind. This pattern stove is very suitable for export as it packs in a very small compass, while it is not only valuable as a cooker in summer, but may be utilized as a heating stove in winter. We recently saw a number of these cookers got up to special order by the Chimneyless Lamp Company for shipment to Smyrna, and the high finish of the stoves, no less than their suitability for use in that climate, seemed all that could be desired.

THE TOPOPHONE.

The aim of the topophone, which was invented and patented by Professor A. M. Mayer, last winter, is to enable the user to determine quickly and surely the exact direction and position of any source of sound. Our figure shows a portable style of the instrument; for use on ship-board it would probably form one of the fixtures of the pilot-house or the "bridge," or both. In most cases arising in sailing through fogs, it would be enough for the captain or pilot to be sure of the exact direction of a fog-horn, whistling buoy, or steam whistle; and for this a single aural observation suffices. Every one has twirled a tuning fork before the ear, and listened to the alternate swelling and sinking of the sound, as the sound-waves from one line re-inforce or counteract those from the other line. The topophone is based upon the same fact, namely, the power of any sound to augment or destroy another of the same pitch, when ranged so that the sound-waves of each act in unison with or in opposition to those of the other.

Briefly described, the topophone consists of two resonators (or any other sound-receivers) attached to a connecting bar or shoulder rest. The sound receivers are joint by flexible tubes, which unite for part of their length, and from which ear tubes proceed. One tube, it will be observed, carries a telescopic device by which its length can be varied. When the two resonators face the direction whence a sound comes, so as to receive simultaneously the same sonorous impulse, and are joined by tubes of equal length, the sound-waves received from them will necessarily re-enforce each other, and the sound will be augmented. If, on the contrary, the resonators being in the same position as regards the source of sound, the resonator tubes differ in length by half the wave-length of the sound, the impulse from the one neutralises that from the other, and the sound is obliterated.

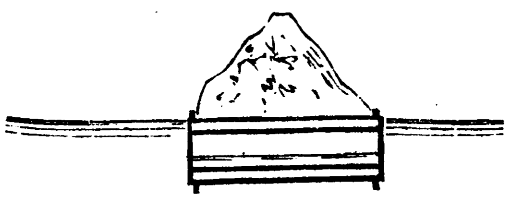
Accordingly, in determining the direction of the source of any sound with this instrument, the observer guided by the varying intensity of the sound transmitted by the resonators, turns until their openings touch the same sound-waves simultaneously, which position he recognises either by the great augmentation of the sound (when the tube lengths are equal), or by the cessation of sound, when the tubes vary so that the interference of the sound-waves is perfect. In either case the determination of the direction of the source of the sound is almost instantaneous, and the two methods may be successfully employed as checks upon each other's report. It is obvious that with such a help the pilot in a fog need never be long in doubt as to the direction of a warning signal; and if need be, he can without much delay, by successive observations and a little calculation, determine approximately at least, the distance of the sounding body.

IMITATION INLAYING.—For an oak panel with a design inlaid with walnut, grain the panel wholly in oil. This is not a bad ground for walnut. When the oak is dry grain the whole of the panel walnut in distemper. Have a paper with the design drawn thereon, and rub the back with whiting; place it on the panel, and with a pointed stick trace the design. Next, with a brush and quick varnish, trace the whole of it. When the varnish is dry, with a sponge and water remove the distemper, where the varnish has not touched. This, if well executed, presents a good imitation of inlaid wood. Marbles are executed in a similar manner.

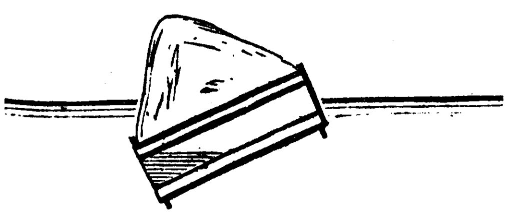
SELF DUMPING SCOWS.

The dirt and refuse matter collected in the streets of New York city, is removed to the ocean, filled up on top of flat bottom scows, in tow of a steam tug, and dumped in deep water. Last winter an accident to one of them gave occasion to an invention; it was noticed that one of the scows was leaky, and shipped water rapidly. The vessel gradually settled, and after a short time turned bottom side up. This led Mr. Mitchell, the contractor, to ponder on the circumstance, which seemed to furnish a valuable principle in automatic dumping. He began to experiment, and finally hit upon a plan on which a model was constructed, and finally he sent in a proposition to the Board of Police Commissioners, offering to take charge and dispose of the entire refuse of the city, at a considerably diminished rate.

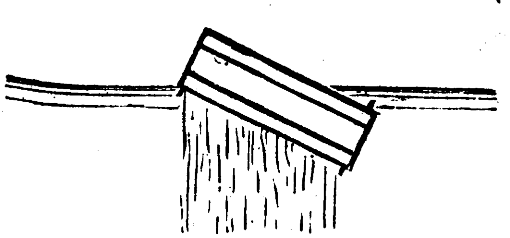
The new scows to be used for this purpose are 100 feet long, 40 feet wide, and 11 feet deep. The top and bottom are alike, and provided with side fenders. The cross section is represented in our diagrams, they have four decks, forming three separate compartments, of which the upper and lower are air tight, while the middle and largest one is a water compartment, and provided with valves, which open to the water underneath the boat. The valves are connected with each other by means of adjusted wires and are manipulated instantaneously by a single valve handle on deck, which opens or closes them at the will of the operator. When the valves are closed the barge is ready for a load. The garbage can easily be piled in a pyramid twelve feet high. A barge of 100 feet long can carry 700 tons of refuse at eight feet of draught, being a percentage of about ninety tons to each foot of draught, including the weight of the vessel itself. When the barge has been loaded as represented in Fig. 1., it sinks until the upper deck is within a foot and a half of the water's surface. In this condition it is towed to sea. When the proper point for dumping is reached, two men approach the barge in a turf boat and pull the valve handle on deck by a pole with a hooked end.



Fig, 1. SCOW LOADED WITH GARBAGE.



Fig, 2. SCOW LOSING EQUILIBRIUM.



Fig, 3. TURNING OVER AND DISCHARGING LOAD.

The consequence is the opening of the four valves which allows the water to rush into the hold of the barge which gradually sinks in an oblique position as represented in Fig. 2.

The centre of gravity, previously supported in on the middle above the centre of buoyancy is thus much displaced to one side, and the whole affair being intentionally loaded top heavy, will after the careening has reached a certain point suddenly turn bottom upwards, precipitating the entire cargo in the water, as seen in Fig. 3.

After being thus automatically unloaded, the air chamber between the two lower decks having fifty per cent. greater buoyancy than the weight of the vessel forces the water chamber high above water line. The water which has been admitted consequently runs out through the open valves. On the next trip the barge floats upside down, the load of refuse being placed on the bottom.

Some incidental advantages are that when a barge requires calking either on the bottom or top, it can be repaired without resorting to the dry dock as only the top is caulked, and when done it is turned over, when the bottom becomes top. Another advantage is that the system of shovelling garbage slowly into the water allows buoyant matter to separate from the rest and rise to the surface, where it befouls the air and drifts in heaps ashore. But when the whole mass is dumped at once the heavy matter carries straw, paper and other light material to the bottom where a great portion of it will become waterlogged, being soaked under hydraulic pressure, and so diminish largely the amount of floating material, which occasionally have reached the shores of Coney Island to the great disgust of the bathers.

The practical importance of improvements in this regard is evident from the fact that it costs the city of New York nearly $200,000 a year to get rid of the refuse collected in the streets, and the inventor holds that 50 per cent. of this can be saved by the use of scows, purposely constructed according to the principles explained here.

WATER SEAL TRAPS IN SUMMER.

A simple and cheap method is to fill the trap with a saturated solution of calcium chloride. This material is a by-product in the alkali trace, for which, in quantity, the manufacturers would doubtless be glad to find a market at five cents a pound. Owing to its hydroscopic character its solution does not evaporate. About five pounds to a gallon is sufficient. To apply it to a water-closet, flush the trap thoroughly, shut off the supply, lift the handle and drop the calcium chloride into the trap, until no more will dissolve. For smaller traps, as in sinks and hand basins, where a slight waste is unimportant, pour in the saturated solution, which, being about twice as heavy as the water, will speedily displace it. The calcium chloride may possibly contain a little free hydrochloric acid, which will corrode the metal. Its presence in the solution can be detected by litmus paper, and a teaspoonful of marble dust will neutralize all that can be found in several gallons.

Quick-speed Circular Saws.—Soft-iron discs running at a circumferential speed of 12,000 ft. per minute will cut hard steel, but 5,000 ft. per minute will not cut iron. This fact is taken advantage of in rolling-mills to cut large bars and beams to exact lengths. At the L. & N. Western railway works at Crewe, the circular saws for cutting hot steel have a velocity of 18,000 ft. per minute at the periphery, equal to a speed of about 150 miles per hour. The saws are 7 ft. diameter, and 5-16 inch thick, driven through gearing in one case by a pair of locomotive cylinders 17 inches diameter and 2 ft. stroke; in another instance the saw is driven direct by a three-cylinder engine, 14 inches diameter and 8-inch stroke. At another works a saw of 4 ft. 6 inches diameter is run at 1,200 revolutions per minute, equal to 17,000 ft. per minute. A jet of water plays on circumference of saws to keep them cool.

Removing Paint from Carved Oak.—Wet the oak with naphtha until the paint begins to dissolve, and when it softens take away the paint with a palette knife. The process is a very long and tedious one, as much care is required to prevent the wood being scraped away with the paint, but it can be done. If a great amount of carving has to be cleaned, the labor may be lessened by dissolving the paint by a spirit lamp instead of naphtha. The lamp has a jet of a peculiar structure, which flattens the flame and disperses the heat over a large surface. It is held to the paint, and, when the paint softens, it is scraped with a blunt pointed palette knife. It must be used carefully, or the carving may get burnt.

RAILWAY ACCIDENTS IN ENGLAND IN 1879.

The English papers have lately published from advanced sheets of "The Board of Trade Returns," statements of accidents for 1879. From these it appears that 1,032 persons were killed and 3,513 were injured on the railways of Great Britain during last year. On the face of the returns it would appear that accidents to trains, permanent way, &c., are far more fatal to life and limb in England than in this country, from May, 1879, to the close of April, 1880—a showing which is, it will be acknowledged, highly favorable to American Railway managers. One cause of this difference is due, probably to the fact that all the accidents are reported in England, while in this country no record is kept, or obtainable, of very many that occur.

It may be of interest to give the data concerning the accidents due to failures of rolling stock and permanent way. Of the failures in tires, 63 were engine tires, 37 tender tires, 11 carriage tires, 28 van tires, 1,088 were wagon or freight car tires, of which 888 were tires of wagons belonging to owners other than the railway company. Our readers must bear in mind that the wheels of English cars have wrought iron spokes with tires shrunk on, instead of chilled iron wheels cast in one piece as with us. Of the 1,227 tires which thus failed, 933 were made of iron and 262 of steel, while the material of 32 was not stated. Of the 496 axles which failed, 272 were engine axles, viz., 248 crank, or driving, and 24 leading, or trailing 23 were tender axles, 3 carriage axles, 190 wagon axles and 8 axles of salt vans; 76 wagons belonged to owners other than the railway companies. Of the 248 crank, or driving axles, 180 were made of iron and 68 of steel. The average mileage of 163 iron axles was 183,992 miles, and of 63 steel axles, 157,824 miles. Of the 1,541 rails which broke, 1,363 were double-headed, 130 were single-headed, 32 were of the bridge pattern and 15 were of Vignoles' section, while the section of one was not stated. Of the double headed rails, 849 had been turned; 1,225 rails were made of iron, and 316 of steel.

One peculiar feature of the English accidents is the large number happening to what are classified as Trespassers, and the large percentage of accidents to these, that prove fatal. Of the entire 1,032 killed, 308, or a little less than 30 per cent., were of this class, while of the 3,513 injured, 137, or less than 4 per cent., were trespassers. Further, the only other case in which the number of killed from any given cause exceeded the number of injured, were persons passing over railways at level crossings—30 being injured 64 killed. In the same class of casualties it appears that out of 313 servants of the company whose occupations are given, who were killed, 103, or about 33⅓ per cent were permanent way men, and 156 of the injured, out of 1,460, or a little over 10 per cent. We have no data at hand to show the proportion of accidents in this country that came from similar causes, but we confess that these figures are a revelation to us. The track in England is more carefully guarded from intruders than with us, and yet we question if a complete record of accidents here would show any such mortality from these causes.

SLEEPING POSITION.

The food passes from the stomach at the right side, hence its passage is facilitated by going to sleep on the right side. Water and other fluids flow equably on a level, and it requires less power to propel them on a level, than upwards. The heart propels the blood to every part of the body at each successive beat, and it is easy to see that if the body is in a horizontal position the blood will be sent to various parts of the system with greater ease, with less expenditure of power, and more perfectly than could possibly be done if one portion of the body were elevated above a horizontal line. On the other hand, if one portion of the body is too low, the blood does not return as readily as it is carried thither; hence, there is an accumulation and distention, and pain soon follows. If a person goes to sleep with the head but a very little lower than the body, he will either soon waken up, or will die with apoplexy before morning, simply because the blood could not get back from the brain as fast as it was carried to it. If a person lays himself down on a level floor for sleep, a portion of the head, at least, is lower than the heart, and discomfort is soon induced; hence, very properly, the world over, the head is elevated during sleep. The savage uses a log of wood or a bunch of leaves; the civilized a pillow; and if this pillow is too thick, raising the head too high, there is not blood enough carried to the brain, and as the brain is nourished, renewed and invigorated by the nutriment it receives from the blood during sleep, it is not fed sufficiently, and the result is unquiet sleep during the night, and a waking up in weariness, without refreshment, to be followed by a day of drowsiness, discomfort and general inactivity of both mind and body. The healthful mean is a pillow, which by the pressure of the head keeps it about four inches above the level of the bed or mattress; nor should the pillow be so soft as to allow the head to be buried in it, and excite perspiration, endangering ear-ache or cold in the head, on turning over. The pillow should be hard enough to prevent the head sinking more than about three inches.—*Hall's Journal of Health.*

ASTRONOMICAL OBSERVATIONS AT GREAT ELEVATIONS.

The progress of modern optics is now furnishing observers with telescopes of a power which exceeds the capacities of our lower atmospheres for their constant employment. The obstacles to definition due to this atmosphere have grown to be so nearly a barrier to any rapid progress, that attention has lately been given to the conditions of vision which it is very commonly supposed will be found to be best on mountain summits. There is no exact information on this subject, however, and Prof. S. P. Langley was, therefore, led to make some observations on Mount Ætna during a visit there in 1878, the result of which he records in the July number of the *American Journal of Science and Arts.* His object was to gather some sort of quantitative estimate of the degree of transparency and definition, to take the place of vague statement, and to give a kind of standard for comparison with sites in our own territory. The station chosen was "Casa del Bosco," at an elevation of about 4,200 ft. The observations were directed to the sole end of determining the character of vision, as tested at night on stars and nebulæ, and by day upon the sun. After a limited number of comparisons, he infers that at this station about nine-tenths of the light of a zenith star reaches us, and that only one-tenth is absorbed by our atmosphere. The gain on Ætna over a lower station, as tried by the tests of a double star observer, was more in clearness of the atmosphere than in that freedom from tremor which accompanies good definition. The latter was indeed upon the whole better than below, but not conspicuously so.

Prof. Langley concludes, as the result of his researches, that the balance of advantages for astronomical observations is most likely to be found in a dry atmosphere, and certainly at a great elevation. Such elevations have undoubtedly the advantage of diminishing the atmospheric absorption of the more refrangible rays, an absorption so important that it probably cuts off from us the larger portion of the ultra violet spectrum. The gain for observations of precision will be, though positive, not in itself probably such as to justify the difficulty and expense of such a site; but for the study of the nebulæ and stellar photometry, the gain is very essential indeed, while for almost every problem in solar physics it may be said without reserve that, for rapid progress, such observations have now become not merely desirable, but indispensable. The summit of a lofty mountain, however, is not a desirable station. At an altitude of 10,000 or 11,000 ft. the observer may still enjoy all the conditions of health that fit him for labor, but beyond this unfavorable conditions increase very fast.

Quoting from his own experience of a stay of ten days upon Pike's Peak, at an altitude of between 14,000 and 15,000 ft., Prof. Langley says that at this height the attenuated atmosphere makes a long stay impossible for some, while even for the healthiest the conditions of life begin to be such as to render continuous hard work scarcely possible. At the same time the mountain condenses about itself continuous clouds, so that, except during a brief period in the autumn, the opportunities for observation are far rarer than on the plains. A dry climate and a table land, at an elevation of something like 10,000 ft., sheltered on the side of the prevalent winds by a mountain range, which precipitates their moisture in clouds that rarely advance beyond the observer's horizon, appear to be the more promising conditions in our present knowledge. Upon the whole, through the ideal station, where atmospheric tremor does not exist, and the observer pursues his studies in an ever-transparent sky, is not to be found on any part of the earth's surface yet examined, we find says Prof. Langley, within our own territory, in the dry and elevated table lands of Colorado or New Mexico, every condition which experience points out as favorable.—*Scientific American.*

Saws.—A saw just large enough to cut through a board, will require less power than a saw larger, the number of teeth, speed and thickness being equal in each. The more teeth, the more power, provided the thickness, speed and feed are equal. There is, however, a limit, or a point where a few teeth will not answer the place of a large number.

A CONVENIENT COTTAGE COSTING $1,000.

These designs were prepared to meet the increasing demand for inexpensive and comfortable country houses. The question is frequently asked : "Can a dwelling be constructed for the sum of $1,000 that will contain all the accomodations and conveniences required by an average-sized family, and withal have an appearance that shall not compromise one's self respect ?" The chief difficulty in the way of a satisfactory answer lies in the arbitrary number and character of the rooms required. As a rule, there must be the conventional parlor, dining-room, kitchen, entrances, closets, etc., in the first story, and several chambers above ; altogether approximating establishments costing double or treble the estimated amount. Although such demands are perplexing, their number is so large that they cannot be ignored. Several designs for cottages of this class have been already published in the *American Agriculturist* (see numbers May, 1875 ; May, 1876 ; May, 1877 ; and April, 1878), which may be consulted with profit by those who are considering the subject of building. The plans here given will be fcund to excel those referred to in many respects, especially in the amount of accommodation, having seven convenient rooms, instead of the usual five or at most six divisions.... EXTERIOR (fig. 1).—The side elevation shows the outside appearance of the house. The body is set at a convenient height from the ground, the foundation showing 2 feet above the grades. The outlines of the main building are symmetrical and well defined. The roofs are set at an angle of 45°, giving them them the prominence they deserve. The gables have a touch of ornamentation, and light chamfer work is put along the frieze, and under the windows, giving a finished appearance. The front and rear porches are timber work, also chamfered. In some localities it may be desirable to have more shade in front than is afforded by this porch, in such case a veranda may take its place, crossing the entire front of the house.... CELLAR.—Height, 6½ feet. In the estimate of cost appended allowance is made for a cellar under the wing only, which is sufficient in most cases. Others, especially farmers, wanting all the store-room possible, may extend the cellar under the entire building.—[All the cellar-room should be excavated for the sake of good health, even if the room is not otherwise needed.—ED.]—There are two windows, an outside entrance, and a flight of plain stairs leading to the kitchen above.... FIRST STORY (fig. 2).—Height of ceiling, 9 feet. The front entrance is from the porch to a vestibule, and through it to the two principal rooms. The vestibule has a small window at one side, towards which the front door swings in opening, and at the other side sufficient space is allowed for a hat-rack and stand. The parlor and dining-room are of equal dimensions, and similar in form, both being octagonal in front, and having a single chimney between them. The parlor has front and side windows, and one closet. The dining-room intended as the family living-room, is conveniently arranged, having an open fire-place, three windows, a closet, and direct communication with the front vestibule and rear entry. The kitchen opens from the rear entry, is fair sized, and well lighted. It has a large fire-place, a pump and sink, two closets, and a stairway to the cellar. The rear entry opens from a covered porch, and is lighted by a small window, and from it a boxed or cottage flight of stairs lead to the second story. It will be observed that there are no superfluous halls, or other waste room, every inch of space being devoted to purposes of real utility.... SECOND STORY (fig. 3).—Height of ceiling in the main part, 3 to 8 feet ; in the wing 2 to 7 feet. The roofs, being set at an angle of 45°, are unusually steep, giving increased head-room ; then the partitions surrounding the hall are set to add the height of the vertical walls where most important. There is a hall, four rooms and four closets on this floor. The two front chambers have two windows each, and the chimney between them allows for the use of stoves, if required. The two rear rooms serve acceptably as bed-rooms, the larger one having two windows, will accomodate two persons comfortably. The smaller room has a sash-door, through which light passes to the hall.... CONSTRUCTION.—The foundation and chimney are of brick-work. Frame, of sawed spruce, siding of pine, "novelty pattern." Roofs of pine shingles ; floors of tongued and grooved spruce ; windows, four lights each ; doors, pine, panelled ; plastering, three-coat work ; painting, two coats. The following estimate covers the cost of building by this plan. Those requiring the increased veranda, and cellar space suggested, should add $50. In many localities, suitable stone and sand abound, which may be had for hauling. In such cases, the foundation may be of stone, which, together with the plastering, will cost much less than here calculated.

THE FIFTEEN SCHOOLGIRLS' PUZZLE.—This well known puzzle has been brought out in a handy form by Mr. H. F. Bernard, and is sold by Perry and Co. In a neat box we have seven sets of names of the girls on differently-coloured counters—one colour for each day. On the other side of the counters we have the numbers one to fifteen. The puzzle is to so arrange the names that the schoolgirls while walking three abreast for seven days in succession, shall never find themselves in the same company, There are thus 35 combinations of the names, and no two may occur twice in any of the ranks of three. This is a far better puzzle than the so-called American fifteen, which is chiefly remarkable for the persistency with which would-be solvers alter the conditions to suit their solutions.

WIRE BOOK-SEWING MACHINE.—Mr. Hugo Bilgram read a paper at one of the late meetings of the Franklin Institute on this subject, in which he affirmed that the substitution of wire for thread, which these machines successfully accomplish, marks the next step forward that has lately been made in book-binding. He referred especially to a machine which had been exhibited in operation before the Institute, which acted on the principle of producing a number of U-shaped wire staples which are driven from the inside of each section of the book through the back, and through one wide or several narrow bands of a strong linen or cotton fabric, whereupon the projecting ends of the staples are clinched over, thus effecting a firm connection between the sheets of the section and the band or bands covering the back of the book. The machine fastens a section at each revolution of the main shaft, and may be run at the rate of 40 to 43 revolutions per minute, and the book sections, partly opened, being fed by the operator upon a table which carries the sheet in position to be sewed.

The speaker pointed out that the advantages of this mode of binding, as compared with hand-binding, were greater strength, flexibility, and durability, and a decided saving in labor, inasmuch as one operator, with the machine, was enabled to turn out as much work as five to eight workman by hand-work. The rusting of the wire staples is avoided by using tinned iron.

These machines, it was affirmed, have been introduced with much success in Europe, there being at that time no less than 150 of them in use in England, Belgium, France and Germany, and elsewhere. They have been adopted by the government binders of England and the United States, with the result of considerably cheapening the cost of binding, and improving its quality. The machine binding, it was also noticed, had been found to be especially valuable in the manufacture of blank books, and the adoption of the machine-work for the branch of manufacture in Germany had already caused a reduction in the selling price of such goods. For additional details of the mechanical novelty, we refer our readers to the *Journal* of the Institute for January.

DECORATIVE "TILES" OF METAL.—London *Iron* notices as an interesting novelty the recent application of iron and steel to the manufacture of wall decorations for superseding the ordinary decorative tiles of earthenware. Referring to this new product, that paper speaks of it in very favorable terms : "An examination of the metallic wall decorations, which are termed 'metal decorative tiles,' convinces us that their inventors have devised a substitute for the ordinary tiles, which is not only quite equal to them in appearance, but which possesses many advantages, including that of lesser cost, which render them superior to the ordinary decorative tiles." They are manufactured, as we learn, from soft iron or steel rolled into thin sheets ; both sides of these sheets are then well tinned and afterwards varnished by a special process, the object of which last procedure is to insure complete protection of the plates from dampness. The next process consists in enameling the surface and printing the pattern, and finally comes the glazing. The plate thus prepared is then subjected to a high heat, but not enough to cause vitrification, when the operation is complete. These metallic tiles are flexible, will not fly under heat, and will stand considerably rough usage without becoming defaced. In these respects their advantages over earthenware are obvious. They are fixed in place by pins in the wall, and are fitted to each other by the simple artifice of flanging two of the sides. They can be washed when soiled. The invention has been patented in England, elsewhere in Europe and in this country.

A survey is being made preparatory to the construction of an immense wheat elevator at Prince Arthur's Landing.

AN effort is being made to establish a silk and cotton factory at Picton, Ont., to employ from fifty to seventy-five hands.

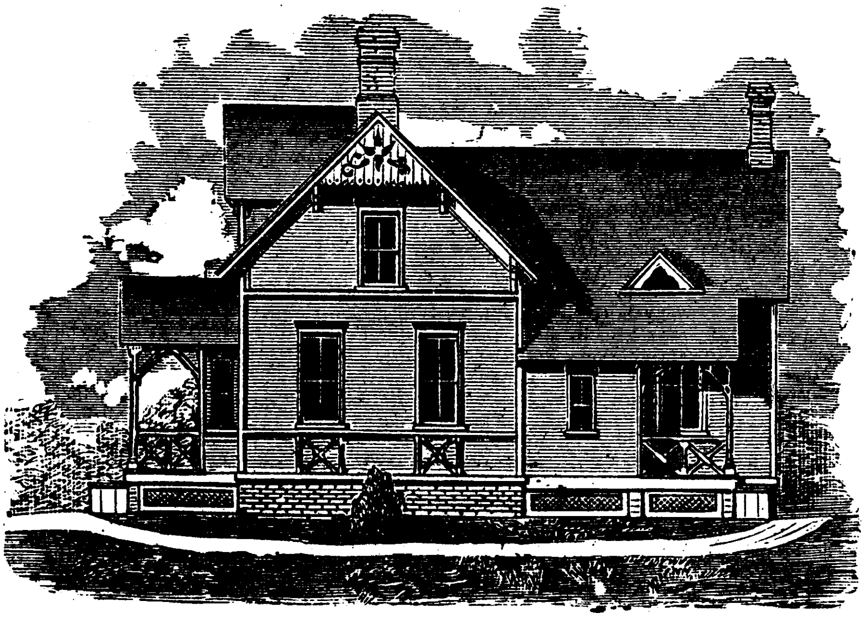


Fig. 1.—SIDE ELEVATION OF THE HOUSE.

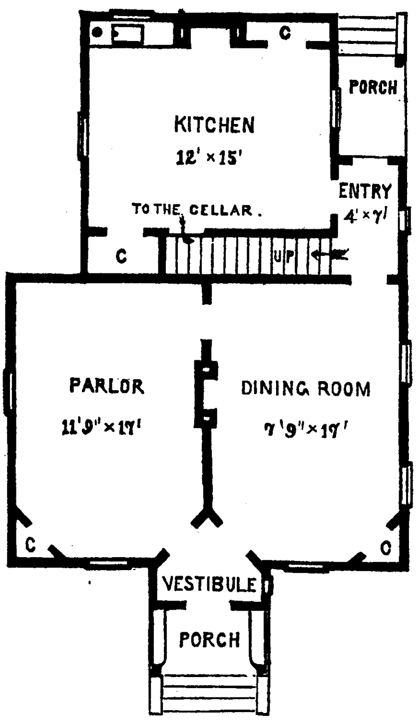


Fig. 2.—PLAN OF FIRST STORY.

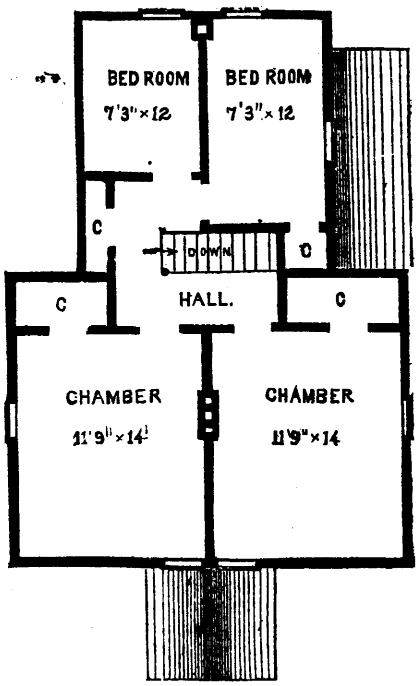


Fig. 3.—PLAN OF SECOND STORY.

DESIGN FOR A MECHANIC'S COTTAGE (From the *American Agriculturist.*)