SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 7. AUGUST, 1879. No. 8.

IS BRITISH INDUSTRY ON THE WANE?—WILL A PROTECTIVE TARIFF ARREST THE CAUSE?

WHEN England had all to gain and naught to lose by free trade with every nation, the doctrine was hailed with delight by the greater mass of her people —but now she has much to lose and little to gain from it, and why? because she has taught other nations to benefit by her experience, and by the perfection of her machines, so that they can manufacture for themselves at cheaper rates than they can buy from English markets.

For years previous to the adoption of Free Trade by England, and which she had done her utmost by commercial treaties to force on other countries, she had been protecting her own industries to an extent unknown to almost any other nation. At that period in her history, that her circumstances required such protection there can be but little doubt, but when she had grown in strength and wealth, and was recognized among nations as the great workshop of the world; when her improved machinery in every branch of manufacture had, to a great extent, superseded manual labour, then she felt that her industries no longer required protection, and that the policy of promulgating the doctrine of free trade became a necessity to the nation, in order that every port might be open to receive, free of duty, those manufactured goods in which she had no competitors, and that her people might be kept in constant employment. But with all the success that attended such a policy, it could not last forever. It was only a question of time and the progress of civilization which caused such rapid strides to be made in art, science and machinery, when other nations—offshoots of the parent tree—would, in their turn, become skilled in the manufacture of those articles made in England, which they were admitting free in their own countries. Such nations would, in the course of time, become powerful rivals. The period has now arrived when Canada, the United States, France, Germany, and other countries, can manufacture for their own requirements, and spare enough to import into England, and sell as good an article and at as low a price as they hitherto received from abroad, and on a class of goods, too, which England had drove with almost an absolute monopoly. And now, when every nation is developing its own resources, Great Britain has to seek for other channels to find employment for her people. Already are there indications of a growing feeling of discontent shown by formidable union strikes, and the low muttering of a suffering people, that foretell the storm, so that means must be adopted to give to British manufactures and British industries of all kinds a fresh impetus. Her trade is becoming paralyzed by the force of foreign competition, her people are suffering poverty for the want of employment, and famine is once more pointing its finger at Ireland and may soon be again stalking over that unfortunate country.

In the natural course of the progress of civilization it could not but have been foreseen by political economists that the days of free trade in England could only exist whilst that country was receiving the whole benefit of the arrangement. But the great natural resources of this continent, and its rapidly increasing population, particularly that of Canada, naturally created a feeling to turn into account those rich gifts which nature had placed within their reach, and by developing them to their own use they would find employment for their people, and no longer be dependent upon Great Britain, or upon any country, and they thus began to build up their own industries and benefit by the past experience and improvements made by other nations. The wealth England had acquired and her commercial greatness were only an incentive to people coming of the same stock to become ambitious also of commercial greatness and independence as well, even had they at first to pay higher prices for goods manufactured at home, as the money was circulated among their own people, and, therefore, so long as they built up their own country, greater cheapness and abundance would be secured in the future. The very advantages that England would still obtain in the exportation of such classes of goods in which she has had the supremacy is lost to her now by "hostile tariffs," and treaties which once secured her valuable international advantages in national trade, are allowed to expire without any prospect of renewal. It is not then to be wondered at that English manufacturers have so much anxiety for the future, and that a growing feeling of discontent is felt against free trade, and that protection is now sought for by many to guard themselves from being undersold by those very countries from which they once drew their wealth—who now in return compete successfully with them in their own markets, and draw wealth from coffers into which they at one time poured millions. The machinery of Great Britain is equal to the requirements of half the world ; and that of the United States could, if fully employed, supply the other half ; therefore it evidently seems conclusive that, without an enormous and continuous export movement, only a small part of England's machinery and labour can be profitably employed, and when that comes to pass, poverty and ruin must come to her, or to any other commercial nation whose main source of wealth depends upon her manufactures and not upon her agricultural productions. If other nations have derived benefit from protecting their industries, they are of a kind that will not lightly be surrendered, because the protection of those industries benefits most directly the working classes. There has evidently been too great an indifference or security felt by British manufacturers to the rapid progress of other nations to perfection in those very matters in which they held the supremacy. It is possible that, although tardily awakening to the fact, and alarmed at the war of competition being carried into her own country, she will throw aside her conservative notions and more energetically exert herself hereafter, so as to still be able to undersell other countries in certain classes of goods. With her vast accumulated wealth, trained skill and long experience, backed by the enterprise of her merchants and manufacturers, and, also, the readiness of her government to promote the interests of British commerce, Great Britain may long remain a great commercial manufacturing nation, and probably she will, for many years, find new fields from which she can reap future wealth.

The United States may well take a lesson in time from the present depression in business, that, to a very great extent, has been brought about by the rapid improvements made in machinery, which has enabled her to manufacture much in advance of the requirements of the nation.

GEOGRAPHY.

The North-east Passage Successfully Accomplished.—At the time when the anxiety of his friends and of the scientific world at large had culminated in the equipment of a special expedition for his succor, and when even the more sanguine confessed their apprehension lest the history of the unfortunate enterprise of Sir John Franklin had been repeated in his case, the happy announcement is made that the "Vega," with Prof. Nordenskjöld and his crew, had reached Behring Strait in safety, having accomplished the memorable task of passing, by way of the Arctic Sea, from the Atlantic to the Pacific. After recruiting the energies of his men, Nordenskjöld proposes to return to Europe by way of the China Sea and Indian Ocean and the Suez Canal.

The voyage just accomplished is the third of Nordenskjöld's Arctic enterprises. Having in the two earlier voyages demonstrated the practicability of navigating the Sea of Kara, and of establishing, by this new highway, a profitable maritime commerce with Eastern Siberia, Nordenskjöld boldly affirmed the possibility, at certain seasons, of reaching the Behring Strait and Japan and China by the Arctic Sea. To test this practicability, the present expedition, on a larger scale than any of its predecessors, was fitted out and sailed from Gothenburg on the 4th of July, 1878, on the ambitious enterprise which has just been crowned with success. We have already recorded that the "Vega" (Nordenskjöld's ship) and the "Lena" (her companion vessel) sailed in safety through the Kara Sea, reached the mouth of the Yenesei, in North-western Siberia, on the 6th of August; and that, sailing thence on the 9th of the same month, they doubled the North Cape of Asia on the 19th, and on the 27th reached the mouth of the Lena, where the "Vega," parting company with her consort (which proceeded up the river), set out alone to accomplish the last and most hazardous task of reaching the straits. Of what transpired after the "Vega" left the mouth of the Lena, the details are yet unknown. It appears to be probable, however, that she was caught in the ice and detained for months near Kellett Land, where she safely rode out the Arctic winter, and at length, as is now reported, happily reached the goal of her intrepid commander's ambition.

Hot Mines.—Probably the hottest mines in the world are those situated on the Comstock lode in Nevada. The highest mine temperature reported to the British Coal Committee was 106 deg. Fahrenheit, but some of the Cornish mines have shown an air temperature rising to 113 deg. Fahrenheit. The hottest water reported in a Welsh mine was at 125 deg. Fahrenheit (J. A. Phillips). In the Comstock mines, according to Professor Church, who has lately described the conditions, the air is never hotter than the rock, as it is in Cornish mines, and the rock in the lower levels (1,900 ft. to 2,000 ft.) appears to have a pretty uniform temperature of 130 deg. Fahrenheit. The readings were obtained by placing a thermometer in ordinary dril-holes, 10 in. to 3 ft. in dept, immediately these were finished, and keeping them there 10 minutes to half an hour. The mining in the Comstock proceeds with remarkable rapidity, the drifts being advanced 3 ft., 5 ft., and sometimes even 8 ft. or 10 ft. a day, so that there could not be any sensible diminution of heat at the bottom of a drill-hole. The temperature of the air is subject to more fluctuations than that of the rock, for the simple reason that it is artificially supplied to the mine. In freshly-opened ground it varied from 108 deg. to 116 deg. Fahrenheit; but higher temperatures are reported at various points (reaching 123 deg. Fahrenheit in one case). The water reaches much higher temperatures, 150 deg. Fahrenheit and upwards. One small stream that has flowed 150 ft. over the bottom of a closed drift with little evaporation gave 157 deg. Fahrenheit. Belts of excessively hot ground are often met with in these mines, and also, though fewer in number, belts of unusually cold rock.

The Largest Locomotive.—Uncle Dick, says an American paper, weighs 65 tons, and he is 60 ft. long from his head-light to the rear end of his tender. He is the biggest locomotive in the world, and has been turned out of the Baldwin Locomotive Works for duty on the precipitous inclines of Atchison, Topeka and Santa Fe Railroad. A boiler 21 ft. long supplies steam for cylinders 20 in. by 26 in., and gives motion to eight 42 in. drivers, while a large tank surmounting the entire structure not only carries a water supply, but helps to give Uncle Dick a tighter grip on the rails. His driver will have control over three independent systems of air-brakes, and can bring to bear at once upon his wheels a restraining force of 75 tons, which is none too large, inasmuch as a "shoe pressure" of 50,000 lb. is required to keep him, when standing still and alone, on the steep road over the Ruton Pass from surrendering to gravitation and rushing down hill by his own weight. How heavy these grades are can be understood when it is noted that one end of Uncle Dick will often stand more than 3 ft. higher than the other, so that in travelling his own length will do the work of lifting about 250 tons a perpendicular foot. And yet this monster, rejoicing in his strength, will rush up the flank of the Rocky Mountains with ten loaded cars behind him.

Properties of Glycerine.—Glycerine should not be rubbed on the skin in an undiluted state. One of its remarkable properties is its power to absorb moisture, and hence its irritating effect on the skin. About three fluid ounces of water to one of glycerine will form a mixture which will neither attract moisture nor evaporate, the weight scarcely varying from week to week, either in one direction or the other. The mixture should be kept in a cool, moist place, and used as required.

Sanitary Items.

POISONED AIR IN DWELLINGS.

An exchange says: "A scientific man who takes great interest in the subject of drainage, holds that 'two-thirds of the miasmatic troubles in New York proceed from the kitchen sinks of the city houses. The sink-drain gets clogged with grease, and foul odors arise to the upper stories of the houses, and little pale children inhale them all night, until they have scarcely strength enough in the morning to put on their shoes and stockings.' For want of a better remedy, says the New York *Sun*, a common brick placed over the aperture will nearly obviate the trouble, and it should be the duty of every sensible head of a family to see that it is regularly placed there. A woman says that is a man's idea. The duty of every head of a family is to see that the sink is kept clean and free from grease, and that from the drain no foul odors can be thrown back into the house to poison its atmosphere. This is very easily done by a plentiful use of washing-soda to kill the grease and keep the pipes free from it, and the occasional use of chloride of lime to sweeten the drain. The cost is but little, and the enemy is cleared out instead of being bottled up, according to the *Sun's* advice. Keep your sink clean and the pipes free from dirt, then clap on your brick if you want to."

To this we add that there is no necessity that the children, or anyone else in the house, should inhale such foul air all night; let them sleep with the windows open more or less, in proportion to the strength of the wind, and thus give admission to the out side air, shutting off the inside air of the house from their bedrooms, if necessary, and the health of the family will not entirely depend on a kitchen sink.

PAINTING WALLS -SEASONABLE HINTS.

Of course, says the *American Builder*, everybody knows, or ought to know, that walls and ceilings are finished with plaster. But everybody may not be aware that plaster has the property of absorbing moisture. This, perhaps, will not take place in rooms where a fire is kept steadily; but in rooms left, as is often the case, for weeks without a fire, the walls will take up a considerable quantity of damp. The effect will be injurious to the health of the inmates. There are few persons who have not suffered from a mysterious cold, caught they know not how, though, perhaps, damp in the plaster had something to do with it.

The extent to which damp is absorbed in a plastered wall may be discovered by noticing what so often takes place in rooms where the walls are painted and have become chilled by a season of cold weather. As soon as the temperature becomes warmer the atmosphere is condensed on the walls, and at times in such quantities as to run off in streams. Now, had it not been for the paint, the greater portion of this moisture would ha e been absorbed by the plastered walls. And as a consequence the quality of the plaster would have been impaired and the room made unwholesome. In view of this effect in plastered walls, it becomes a question well worth considering, whether, in finishing a house, the walls should be papered or painted. If paint is decided on, it is highly necessary that the painting be properly done and good materials employed.

DRAINAGE.

The State Board of Health of Massachusetts has lately made public the following useful information:—

Local boards of health are reminded that, at this time of the year particularly, special attention is required to secure cleanliness about dwellings and throughout towns.

No decaying matter should be allowed in cellars. On the contrary, they should be kept sweet and clean, and as much exposed to fresh air and sunlight as possible. They should also be made dry, by draining if necessary. It should be remembered that the air of houses is supplied largely from cellars; so that the common practice of storing all sorts of rubbish there should be condemned. If the air of the cellar is impure, it often gives rise to various ailments in the persons breathing it in the rooms above; and not seldom becomes one predisposing cause of such diseases as typhoid fever, diarrhœa, dysentery, cholera infantum, diphtheria, scarlet fever, sore throats, and numberless conditions of ill-health which cannot be described under any particular name. If the air in the cellar is damp, neuralgia, rheumatism, and affections of the lungs and other respiratory organs are very apt to follow.

The air supplied to furnaces should never be from cellars, but from the outside atmosphere, and, if possible, on the sunny side of the building. This is a very important matter in schools, where there would generally be no difficulty in following the best methods. The air supply should never be drawn from shady back yards, or the vicinity of privies, sink-spouts, etc.

If kept clean ashes may be used to advantage in filling up low spots of land, making paths, etc.

Garbage should never be allowed to accumulate; all that is not fed to fowls or animals on the place should be *kept in tight* receptacles, and carried away frequently. Pig-pens should not be permitted in thickly settled places.

There should be no soakage into the ground near wells or houses permitted from stables and barns. It will often be found economical to save all the manure, liquid and solid, by receiving it in water-tight vessels, etc., or mixing it with loam, under cover, and frequently carting it away.

Chamber slops, and slopwater generally, should never be thrown on the ground near houses. They may be placed directly on the soil of gardens, etc., or pumped up from water-tight cesspools, or be used by distribution under the surface of the soil, in the manner described on p. 334 of the "Seventh Annual Report of the State Board of Health," and now introduced in *the town of Lenox, Mass. The chamber slops alone* can be easily disposed of by mixing them with ashes or loam, as at the Pittsfield Hospital, by the method shown on p. 87 of the "Ninth Annual Report of the State Board of Health." If the kitchen slops are discharged directly into a cesspool, care should be taken that the pipes do not get clogged with grease.

Earth closets serve a good purpose, particularly for sick people and invalids, if carefully attended to, and if well dried loam be used for them in sufficient quantity; they are more easily managed if liquid refuse be kept out of them.

The ordinary privy should be abolished. It is dangerous on two grounds: 1st. It must be so far from the dwelling as to seriously expose children, particularly during bad weather. 2nd. It corrupts the air, the soil, and consequently too often the wells. Instead of the common privy-vault, which is not safe even if cemented, it is best to use under the seat some receptacle which can be frequently removed and emptied. Galvanized iron tubs, barrels sawn through the middle, etc., answer the purpose very well. If kept thoroughly disinfected with dry earth or ashes, they can be near houses, connected by passageways, and will not corrupt the wells.

If water closets are used, and there are no sewers, the best disposal of the sewage is by the flush-tank, and irrigation under the surface of the soil, as described on p. 135 of the "Eighth Annual Report of the State Board of Health" If cesspools must be used, they should be tight, and often emptied by the odorless process, or else have their contents pumped out on the surface of the ground for fertilizing purposes, where that can be done without causing a nuisance. If the sewage is placed on the soil in the morning of a dry, clear day, when the sun is shining, and in places where it may be readily absorbed by the earth, the odors from it are the least offensive. In very loose soil, and remote from dwellings, ordinary loose walled cesspools may be used without danger for a short time; but even then the custom cannot be approved.

The evils arising from want of attention to the suggestions briefly given above are many, and undoubtedly much ill-health can be thus explained. Good water, from deep wells, is much better than rain water, which is soft, and does not contain the lime, etc., so beneficial to health. If the wells and springs are kept free from contamination, as they may be with some care, *until houses and streets become placed closely together, the water* furnished by them is of the very best quality. A few illustrations of the baneful effects, when contaminated, are given.

A clergyman living in one of our towns reports as follows:

"About a year ago my son, thirteen years old, was taken sick with diphtheria. It was quite a severe case, and was very obstinate, resisting, day after day, all treatment; medicines did not have their usual effect. By and by we thought of the water (which was found upon chemical examination to be polluted with organic matter like that found in drains and cesspools). We immediately stopped using the water, concluding that the impure water was the probable cause of the boy's sickness, and the probable reason why the medicines would not work; for they had been mixed in this water, and he had used it for a gargle.

"With change of water, the sick boy at once began to mend, and was soon about the house again. This was the third case of diphtheria in our family within the space of some two years, and they were the only cases in the neighborhood, which led us to suspect something was wrong.

"I had myself been subject to a chronic irritation in my throat, often amounting to soreness and serious trouble, and also to frequent attacks of diarrhœa, especially through the warm weather; but, for a year past, or since we ceased to use that water, I have had no trouble worth speaking of in either of these ways.

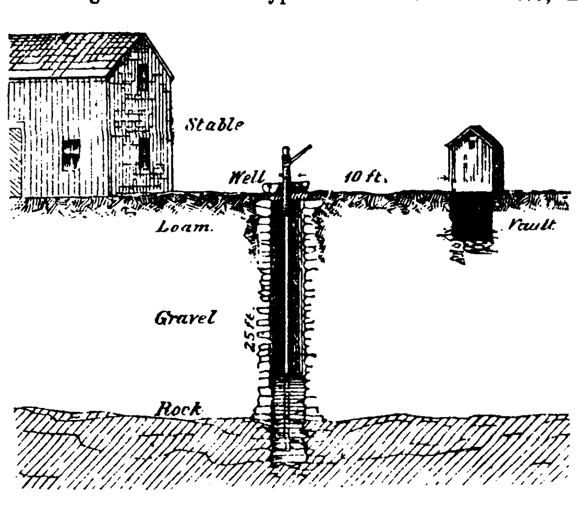
"The well is in the cellar, almost directly under the sink, 3 feet only to the right of it. The top of the well is 2½ feet from the cellar wall. The drain, originally of plank, was 16 feet long, so that the cesspool was within 17 or 18 feet of the well. But this was not the worst feature of the case. This plank drain, after a time, rotted away, so that the filthy water began to soak into the ground just outside the cellar wall, and within 6 or 8 feet of the well, and almost directly over it. The earth, when we removed it to lay a new tile drain, was good manure as deep down as we dug, and I know not how much deeper.

"The water looked clear, except just after heavy rains, and had no ill smell or ill taste about it. We now use cistern water and leave the well untouched."

This case shows what great danger to health may exist unsuspected, when the rules suggested above are not followed out. It is impossible to say that a well is safe at any ordinary distance from a source of constant pollution of the neighboring soil, like a privy, cesspool, barnyard, etc. Often the filth goes a long distance, sometimes not very far. There is always a risk; and, even if well marked sickness does not occur as narrated above, more obscure affections are probably not uncommon.

Dr. J. G. Pinkham, in his "Report on the Sanitary Condition of Lynn," published in the "Eighth Annual Report of the State Board of Health," reports the following two cases, the illustrations in which are most clear and convincing:

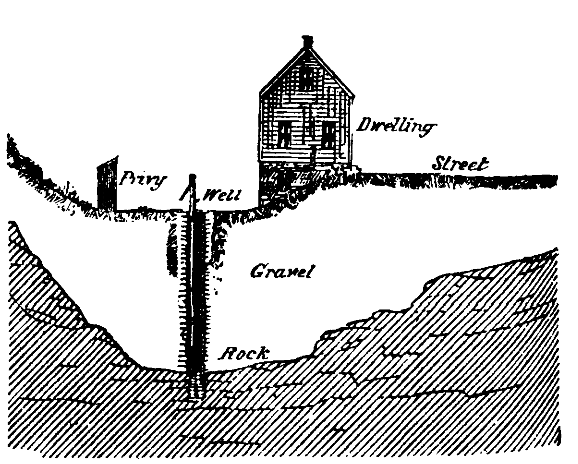
Case No. 1.—The diagram explains the position of the well, and shows the certainty of its pollution. The soil and subsoil are loose; contamination occurs both by surface drainage and from soakage. Five cases of typhoid fever occurred in 1875, in



the family living in the house, and seven more, with one death, among other persons using the well water. This house became the centre of infection for a whole neighborhood.

Case No. 2.—The well is 25 feet in depth, a portion of it being dug into the rock. The vault is 10 feet distant on the same level. There is a cesspool in the garden below, and a stable on the left. The buildings and well are on a side hill. The premises are kept clean, and the water, which is clear and of good taste, has been used for many years. The occurrence of typhoid fever in the family led the physician in attendance to suspect the water, which, upon chemical examination, proved to be very much contaminated. There were five cases of typhoid fever in the family, and several others, with one death, among neighboring persons using the water.

Where wells are not in use the corruption of the air from foul privies, and by the emanation from the soil of the products of decomposition of filth, becomes a prominent factor in the spread of such diseases as typhoid fever, dysentery, diarrhœa, diphtheria, etc. In towns, sources of filth on some premises may be more injurious to the health or more offensive to neighbors than to the occupants of the place itself. Different people are differently



susceptible to disease, too, so that the filthiest places are not always necessarily those where there is most sickness.

A marked illustration of disease due to polluted air, when the drinking water was pure, occurred in a school in this State, in 1864, where 51 out of 77 young ladies in the institution were attacked with typhoid fever, of whom 13 died; 3 servants also died of the fever. The vaults of the privies were shallow, filled to overflowing, and emitted a very offensive odor, which at times pervaded the whole building. The kitchen drain discharged its contents on the surface of the ground, and a few rods from the school there was a foul barnyard.

Where filth has accumulated, and it is necessary to use a disinfectant, or if for other reasons it is desirable to do so, earth, lime, or chloride of lime will serve a good purpose. If it is wanted in liquid form, it may be made by adding to a pailful of water three pounds of copperas (sulphate of iron), with a pint of Calvert's carbolic acid, one pound of chloride of lime, or one half pound of lime.

For use inside of houses, a solution of nitrate* of lead or chloride of zinc† (Burnett's disinfecting fluid) is recommended. Whitewashing in cellars, sheds, etc., is a most excellent means of purifying the air. Prevention of the accumulation of filth, however, is better than the use of disinfectants. "To chemically disinfect (in the true sense of that word) the filth of any neglected district, to follow the body and branchings of the filth with really effective chemical treatment, to thoroughly destroy or counteract it in muck-heaps and cesspools, and ash-pits and sewers and drains, and where soaking into wells, and where exhaling into houses, cannot be proposed as physically possible; and the utmost which disinfection can do in this sense is apparently not likely to be more than in a certain class of cases to contribute something collateral and supplementary to efforts which mainly must be of the other sort" (prevention of filth).

Directions for soil pipes, drains, etc., will be issued in a succeeding circular.

It is in the highest degree important that each town should have an independent board of health to devote their attention to these matters. It is desirable that at least two-thirds of such a board should be composed of persons not otherwise connected with the town government, and that there should be at least one physician on the board.—*Scientific American.*

* One part in one hundred of water. Cloth soaked in such a solution, and hung up in a foul air, quickly destroys bad odors.

† One part in two hundred of water for foul liquids, etc. This is used by order in the German navy for bilge water. Labarraque's disinfecting fluid (chlorinated soda), one part to four of water, may be used with soap.

A Lost Planet.—Among the discovered asteroids, now numbering nearly two hundred, a few have already been lost, and not a few might well be spared. There is one, however, remarks Mr. R. A. Proctor in the *Newcastle Daily Chronicle*, which astronomers would regret to lose, viz., Hilda, which travels in a much wider orbit than any of the others. This planet could give more exact information respecting the mass of Jupiter than any other member of the solar system, coming much more fully at certain times under his influence. Unfortunately, Hilda has been searched for in vain at its first return to opposition, and astronomers begin to fear that the planet, is for the time being, lost.

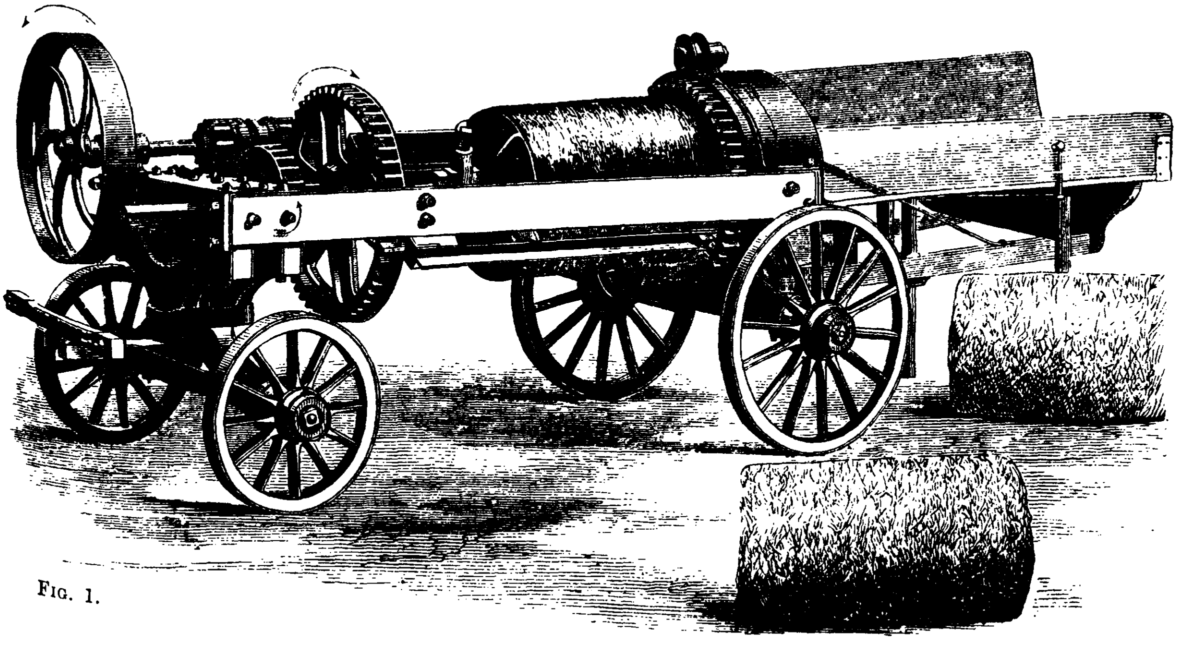


FIG. 1.

PILTER'S ROTARY HAY PRESS.

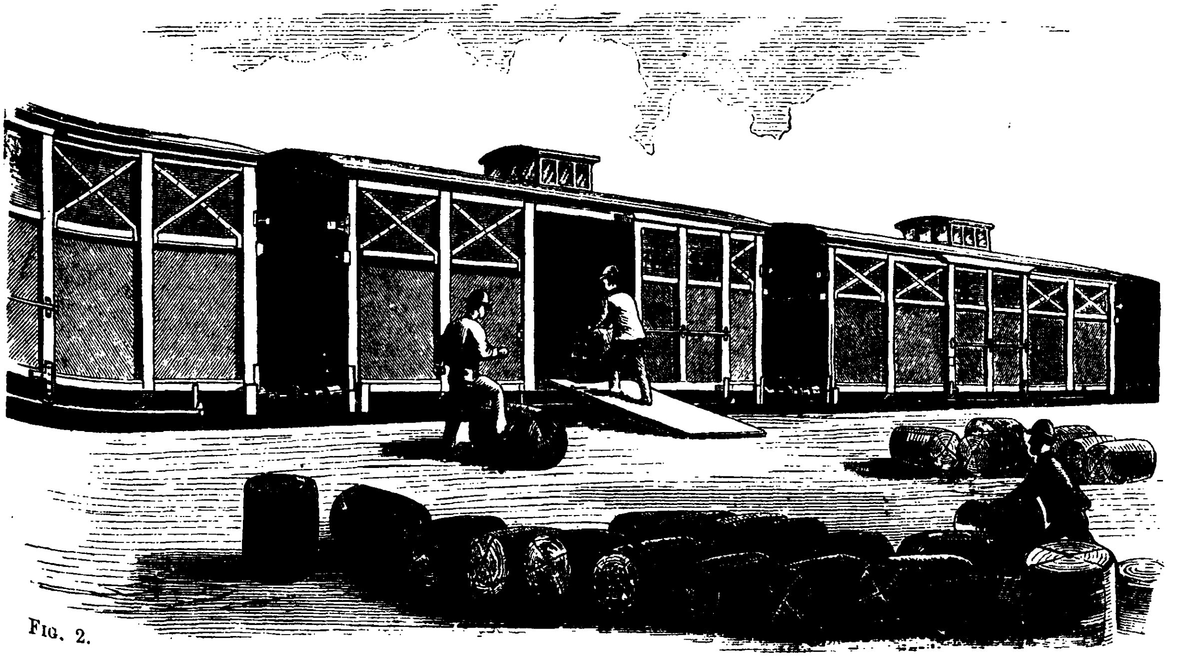


FIG. 2.

LOADING HAY CYLINDERS.

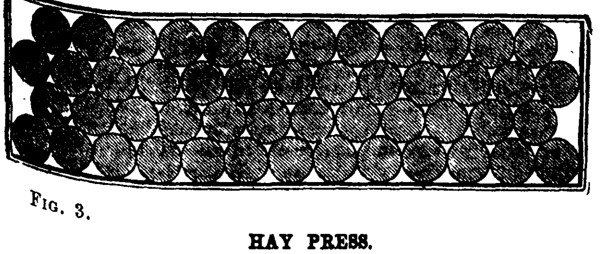


FIG. 3.

HAY PRESS.

NEW HAY PRESS.

The great volume of hay in its natural state renders it very difficult of transport, so that where vast quantities are required for the forage of armies or the wants of large industrial establishments, it becomes necessary to reduce its bulk very considerably. This, however, must be done judiciously, and above all uniformly; for if a certain pressure, determined by experience, be exceeded in any portion of the mass, the nutritious juices are expressed, and the hay rendered comparatively valueless. It is found that hay cannot be compressed like cotton by the application of one direct pressure, but that the consolidation must be effected by two separate operations, one for placing the particles in as close proximity as possible with a slight degree of pressure, and the other to give the final squeeze for reducing the bulk into as small a compass as may be desired. This has generally been effected by tossing the hay into cubical cases, where it is trodden down by men's feet before the final pressure is applied; but this method is open to many objections. The hay is bruised and broken by this rough treatment; no uniformity can be secured in the packing; and the plan enables unscrupulous dealers to fill in the interior of the bale with a damaged or inferior article. Besides this, the form of the bales is very inconvenient, so that they require four men to transport them from place to place.

The hay press exhibited in action by Mr. Th. Pilter, of Paris, at the Cattle and Implement Show under the auspices of the French Minister of Agriculture and Commerce, is improved by him from an American model, and patented in England and France. The hay, thrown on to a platform, is delivered continuously in small quantities up to a circular plate, and passes through two narrow slits, into which it is uniformly fed by two revolving cones, which impart to it a corkscrew motion. The hay is, in fact, roughly spun into a double threaded screw of very fine pitch, and forced onward with gentle pressure until a sufficient quantity has been collected to form a cylindrical bale of the weight desired. A pressure of about 6 cwt. to the cubic yard is then applied, giving the density which is found most desirable; a pressure of 8 cwt. to the square yard may, however, be given if required. The bale is then bound by two steel wires, crossing one another in a longitudinal direction; they are previously looped at each end, and are fastened by simply inserting in the loops a curved link like a small belt hook before it is flattened. On the pressure being relieved the mass slightly expands, stretching the wires; and the bale falls out of the press, a solid uniform cylinder, 2 feet 1½ inches in diameter, which may be rolled along by one man. A bale weighing from 2 to 2¼ cwt. is found most convenient, and for this a power of only three horses is required.

A perspective view, engraved from a photograph of the press exhibited at Paris, is given in Fig. 1. The machine rests upon a pair of wooden carriages, similar to those of a waggon, connected by stout longitudinal frames of angle iron; it is, therefore, easily moved to wherever required for work. The main shaft extends the whole length of the frames, and is supported in bearings, one at each end of the right hand frame or that removed from the point of view in the engraving. A pulley keyed on to the end of this shaft receives motion, by a belt, from a horse gear, portable engine, or any source of power. This shaft carries three spur pinions of equal diameter, arranged quite near the bearings, two at the front end and one, not visible in the engraving, at the back; they all run loose, but are capable of being made fast by friction clutches. When none of the pinions are in gear the main shaft only revolves. When the two hindermost pinions are both made fast on the shaft, they cause the two large spur wheels of equal diameter, arranged along the centre line of the machine, to revolve together. That nearest the front end is fast on the second shaft, which is hollow, and forms the nut of a screw. The other is merely a ring having a flange cast on to it, which is carried by three friction rollers; it has, however, a couple of ribs, cast on the inside of the ring, which fit into notches in the circular head of the press, so that they revolve as one piece when the hay is fed in at the back end. This head is guided by two T irons bolted to the back plate and attached to a collar carrying arms at the front end. The head is also bolted to a square bar of wrought iron, which slides through the centre of the screw, and passes out at the front end. When both the spur wheels are in gear, the second shaft, forming the nut, and its screw revolve together; but when the back wheel is stationary, the revolution of the nut causes the screw to advance, forcing the head toward the hinder end. For bringing back the screw a smaller spur wheel, the boss of which also forms a nut, is made to revolve in the contrary direction by means of an idle wheel or carrier; and the front spur pinion is thrown into gear by a double clutch at the front end. A bevel wheel cast on to the annular spur wheel at the back end (not seen in the engraving) turns the cones, which are centred in the ribbed plate, and also takes into a bevel pinion, giving motion to a short longitudinal shaft, which, by means of a pair of mitre pinions, rotates a transverse crank shaft, actuating the shakers. There are four of these shakers with rake teeth, two on each side of a central division (not shown) for keeping separate the two streams of hay fed in by the two cones. This division is made movable for permitting the wires to be inserted for binding the bales.

Having described the principal parts of the appliance, we will now proceed to give an account of the operation of compressing the hay and forming the bales. Both the large spur wheels are thrown into gear, so that the screw, nut, and head revolve together. The hay is then thrown by forks on to the platform by two men, one on each side, and is carried on by the shakers to the back plate, where it is drawn uniformly through narrow rectangular apertures by the revolving cones. The head is at first close up to the back end; but the pressure exerted by the cones, introducing the hay, forces it gradually forward; and teeth are attached to the head for preventing the hay from slipping round it. In order to cause sufficient resistance of the head on the square bar, the latter is provided with a brake screw, which is turned as tight as experience shows to be desirable. When a sufficient quantity of hay has been fed in to form the weight of bale required, the back pinion, spur wheel, and cones are thrown out of gear, and the large spur wheel at the front end kept in gear; as the boss of this wheel forms a nut to the screw, it causes the latter to advance and drive back the head until it has given the hay the amount of compression desired. The bale is then bound by the two steel wires as described above; the double lever clutch throws out the larger spur wheel, and throws in the smaller, thus bringing back the screw; and the bale falls out, ready to be rolled away wherever required.

The operation of the machine is one of the simplest character, requiring only a power of three horses, the labor of two men, and from three to five minutes of time, according to the size of the bale.

Fig. 2 shows the method of loading the bales into railway cars; and Fig. 3 a plan of the car with the arrangement of the bales as stowed away. It will be evident that this new hay press possesses considerable advantages over those which have preceded it.—*Iron.*

THE TRANSMISSION OF POWER BY BELTING.

The results of an extensive series of experiments on belts and belting have been published in France by M. Leloutré, in the "Transactions of the Société des Ingénieurs Civils." The subjects examined were the elongation, elasticity and breaking strain of driving belts made of leather, indiarubber, webbing and canvas; and the slipping of belts and cords. Some practical applications made of these results in the transmission of power by belts, are also given.

The experiments on elongation, elasticity, and breaking strain were made by cutting from any leather belt, or from the hide, a strip about 30 inches long and 2 to 2½ inches wide, which was further subdivided into three or four narrower thongs, for testing in different ways. Two fine lines were marked across the thong, at a distance of 20 inches apart; and the width and thickness of the thong were carefully measured at several intervening places, to determine the corresponding transverse sectional areas, the minimum of which was taken for calculating the strains. Any probable errors involved in the results so arrived at did not exceed 2 per cent.

The general results of the experiments on leather, indiarubber, webbing, and canvas, are that the elongation produced by a tensile strain is in no respect proportional to that strain, but increases always less rapidly than the tension; in other words, the modulus of elasticity for these materials rises higher and higher as the load increases, while for metals it falls lower and lower. One curious fact, however, which the experiments disclose is that, while the elongations or successive increments of length become less and less up to a certain load, they then become greater and greater, showing a point of maximum power of resistance, which is then followed by a falling off; after this decline of resistance, the elongation again becomes less rapid up to the breaking strain, on approaching which the resistance is generally greater. In ordinary leather the maximum resistance to stretching is met with at a strain of about 850 lbs. per square inch; in indiarubber and webbing it occurs at rather a lower strain. It is evidently advantageous, therefore, that the working strain on a belt should be fixed as near as possible to that at which the maximum resistance to stretching occurs, or, say, from 700 to 800 lbs. per square inch. This is largely in excess of the tension generally recommended of 200 to 300 lbs. per square inch, which itself is even regarded with timidity by many engineers. Should the point of maximum resistance to stretching be accidentally exceeded by the strain in working, no trouble will be experienced. This is owing to the fact, demonstrated by experiment, that the elasticity of leather and webbing is perfect; for when thongs have already been twice torn asunder, the severed shreds, after having been stretched 1½ inch per foot, have been found with fifteen months' rest to recover exactly their original length.

In experimenting on the slipping of belts and cords upon polished pulleys, the very first results obtained pointed to the fact that the coefficients of friction employed in so many of the formulæ in practical use must be two or three times too high. In consequence of so wide a discrepancy, he undertook an extensive series of careful experiments. Over a pulley, keyed upon a stationary horizontal shaft, was passed a belt, with both its ends hanging free, and loaded with equal weights; the load on one end was then gradually increased till its preponderance caused the belt to slip. One reason why the results differ from those obtained by others, is believed to be the circumstance that the slipping of a belt or cord upon a polished cast-iron drum can be caused to take place under widely differing conditions. With a sufficient excess of the heavier over the lighter of the weights suspended from the two ends of the belt, the slipping produced can be brought up to 2 inches per minute; when it attains about this rate, the motion no longer continues uniform, but becomes uniformly accelerated. By considerably diminishing the tension on the heavier side, the slipping may be brought down to the almost imperceptible rate of less than ⅛ of an inch per hour; and by trial such an adjustment of the weights may be got that the slipping shall continue with great regularity throughout a whole day. In certain instances, however, the rate of slipping could not be reduced below a minimum of ⅜ of an inch per minute.

The experiments accordingly furnish minimum valves for the coefficients of friction; higher valves are of no practical utility in relation to the transmission of power by belt gearing, and can but lead to error. In these experiments the diameter of the pulleys, the face of which was either straight or rounded, varied from 4 inches to 8 feet, and the width of the belts from ⅜ inch to 12 inches; the arc of contact was 180 degrees, 540 degrees, 900 degrees and 1,260 degrees, the belt making respectively ½, 1½, 2½ and 3½ turns round the pulley; and the tensions on the two hanging ends of the belt ranged from the lowest to far above those employed in practice. The trials of hemp and cotton cords comprised ropes of ¼ inch diameter (say 4 inches girth), cords of ⅜ to ½ inch diameter, twine, and even sewing thread; the pulleys were either plain, or with a circular or V-shaped groove. For dry new leather the coefficient of friction averages 0.155; for old greased belts on well-polished pulleys it rises to 0.200 or 0.220; while on pulleys that are not well polished it may rise to 0.300 or 0.330. For moist new leather the coefficient may fall to 0.120. For ropes, cords, twine and sewing thread it varies from 0.070 to 0.075. It is altogether independent of the number of degrees in the arc of contact between the belt and the pulley, or of the area of pulley surface covered by the belt. Temperature seems to have no effect, even between the extreme limits of 77° and 10° F. (or 45° F. above freezing point, and 22° below.)

From a careful study of the results obtained in a number of instances in which the transmission of power by belts and cords has been practically carried out under his direction—and especially in four particular cases where the power to be so transmitted was respectively 40, 80, 150 and 750 horse-power—M. Leloutre has arrived at the conclusion that belts or ropes are commonly made twice or three times as strong as they need be, and are stretched far too tight, even to the extent of springing the shafts and breaking the pulleys. The degree of tightness should never be left to the workmen, but should be carefully adjusted, by the aid of a dynamometer, to an amount from 10 to 12 per cent. in excess of the tension determined by calculation to be requisite. The whole gear can then be relied upon to continue in good running order for several months: rapid wear of the bearings and heating and seizing of the journals will be avoided, as well as rapid destruction of the belts and ropes and serious loss of power.

A Steam Car for Local Travel.—There has recently been turned out from the Central Pacific shops in this city a new dummy car, in which the locomotive, mail, baggage and passenger compartments are combined. The car will be used on the Northern Railway and will run between Woodland and Williams. It is of very neat and compact design, as ornamental in appearance as an ordinary passenger coach, and will do away with the use of an engine and numerous cars which have heretofore had to be run between those places. The total length of the car is 61 ft., including the platforms. In front is a small engine with an 8 x 14 in. cylinder, two drivers, each 42 in. in diameter, and a coal box. Next to this is an apartment for the baggage and mail, and then comes the section to be used by the passengers. Thirty persons can be comfortably seated in this apartment. Underneath the baggage compartment is the water tank, and the car is provided with the Westinghouse air-brakes. The work inside and out has been finely finished and presents a very neat appearance.—*Sacramento (Cal.) Bee.*

WARMAN'S UPRIGHT PIANOFORTE ACTION.

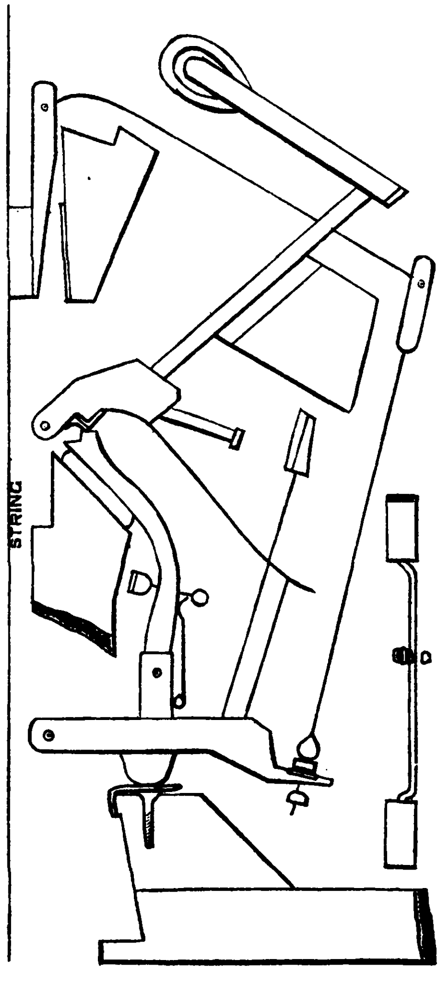
This action (the first complete drawing was made about 1870), has been designed by Mr. Warman, as a little relaxation from the severer duties of organ-labour, and is the result of several years' practical experience among pianoforte mechanism of all sorts, and by all makers. It is believed by him to be as practically perfect as it is possible for an *Upright* action to be, and to be surpassed—and this only in the matters of *Repetition* and diminution of chance of *Blocking*—by no models except those of *Erard* and *Hopkinson*, which are both of them expensive and adapted only to horizontal instruments, that of Erard being, in addition, very complicated and difficult of partition

Owing to the large number of pianoforte actions now in use—some of them of great excellence—Mr. Warman has determined not to incur the cost of a patent, but to throw the model open to the trade at large. Its general superiority will be apparent from the following:—

Advantages over all other Pianoforte Actions known to Inventor.—1. The hammer-shank stands at such an angle as to *average* being correct for *sufficient* weight to return the hammer and *no more;* the shank is never either perpendicular or horizontal. The hammer is thus less likely to stick on the centre wire, than with other upright actions, and yet does not fall on the ruler with the thump liable in the grand. 2. The escape contact is in *fractionless direct* action, and this, without sacrificing the accessibility of the hopper for regulation, or losing the facilitation of the escape given by the *inward* motion of the hopper lower centre. 3. The weight of the lever and hopper can be, if desired, thrown on the *damper* (to assist damping), *without* either placing the latter on the wrong side of the blow (*i.e.*, farther from string centre than blow is), or having to pass a wire between the hammer heads. This advantage is, as will be seen, secured by the simple expedient of passing the damper-tail between the hammer-*shanks*.

Advantages over all other Upright Actions known to Inventor. 1. The damper can be, as just said, *correctly* placed, without either requiring the strings to be turned upwards, as in Wornum's grand piccolo (thus necessitating a very expensive and ungainly form of instrument), or throwing the hammer-centre farther from the string, as in Erard's upright actions (this latter involving a slight *rake* or *passage* of the hammer-head along the string, injurious to good tone). 2. An excellent *repeat* is furnished by the block on the hopper, and thus the extreme end of the latter can be permitted to escape *entirely* from the hammer-butt. This avoids the risk of blocking, or the repeat failing altogether, inevitable when the step is dispensed with (as in the ordinary "French" action); and it also precludes the friction of the Brinsmead action, in which the hopper is kept in constant contact with the butt by means of a spring. 3. The stem-wires of both cheeks and ties are *cranked*, thus much facilitating the regulation of the escape. 4. The return fall of the hopper-blade is perfectly *quiet;* being made against an ample surface of soft felt. 5. No wire passes between the *heads* of the hammers. 6. The weight of the touch is the same whether the *loud pedal* be down or not, without the necessity of a wire passing between hammer-heads (as just stated). 7. The *length* of the (bass) strings is increased, without either slanting them or employing a sticker, by four causes, viz., the block on end of key-tail, the spur under the lever, the increased length of the hopper, and that of the hammer-shank. All these four have not before been *combined* in one instrument. 8. The tail cloth is so applied as to render it not liable to *turn back* when the key is inserted.

Advantages Shared by Some Other Pianoforte Actions.—1. Moderate but not excessive *lightness*, given here by the angle at which hammer-shank is set. 2. A swift and yet fractionless *escape*. 3. *Simplicity*, thus ensuring moderate cost. 4. Great *durability*, no parchment being used anywhere (all centres being by bushed holes on wires), and the fraction everywhere reduced to a minimum. 5. The freedom of escape, while allowing always a sufficiently powerful blow for all legitimate playing, yet much decreases the chance of *breaking* a hammer-shank. 6. Facility of *regulation* everywhere, including that of damper, which latter is in many actions very difficult of proper adjustment; and of upper contact with hammer butt, which is, in the ordinary upright action, a most laborious process. 7. Non-liability of hammer *blocking*, or action becoming in any way deranged through atmospheric causes or changes leading to deepening of touch or other alterations. 8. The check is thoroughly effective and *releasive*, and the stump at the same time assists the return of the hammer. 9. The trace is easily detachable, and yet it can never kink—as was often the case with the first horizontal free-hopper actions made by *Wornum*, and still has not the disadvantage of difficulty in removal presented by the modern actions by the last-named maker. 10. Either the hammer and level-rail, or the damper-rail, may be easily *detached* without touching the other rail or affecting or displacing any other portion of the action. This is effected by screwed slips. 11. The action is extremely little liable to get out of *order*. 12. The damper being below the hammer-head, there is greater facility for tuning by wedge-stop, thus favoring the employment of the interposed form of soft pedal, or the use of three strings to one note. 13. The hammer-shank is so planted, and the hammer-block is of such a form, that both assist the return of the hammer, independently of the lower angle at which shank of latter is set.



WARMAN'S UPRIGHT PIANOFORTE ACTION.

The loud pedal is obtained by pushing the bass end of the damper-beam a little away from the strings in the usual manner. The soft pedal is *preferably* obtained by the interposed method—*i.e.*, a strip of felt between hammer and string; for tuning, the entire action may—if the stringing permit of it—be moved a little to the right, the necessary provisions for this being made in the fitting of the action frame.

A light spring may be applied beneath the damper-tail if an easier touch be desired. If greater length of string be required without obliqueing, employ a sticker between the key and the hopper-lever; the tail-lever at bottom of sticker should be of solid buckskin, as in the former Wornum sticker-action. The hammer-shank may, if desired, be ½ in. shorter than in drawing (which latter is nearly half-size), and the hammer-head reduced in thickness. With oblique stringing there may, of course, be addition side-surface given to the under-spur of the hopper-lever.

The points in the action which are Mr. Warman's own improvements are these:—1st. The position and design of the damper. 2. The repeating block to the fly or hopper (a similar block has, however, long been applied to the common hopper). 3. The direct-action-of-escape *without* sacrificing the exterior regulation of the same. 4. Cranked check-wire and tie-wire. 5. Increased length of string. 6. Improved affixure of key-tail cloth. 7. Actuation and regulation of the damper. 8. Angle at which hammer is set. 9. Wire between hammer *shanks*. 10. Noiseless fall of hopper, and easily renewable bed for ditto. 11. Facility for independent removal of any portion of the action.

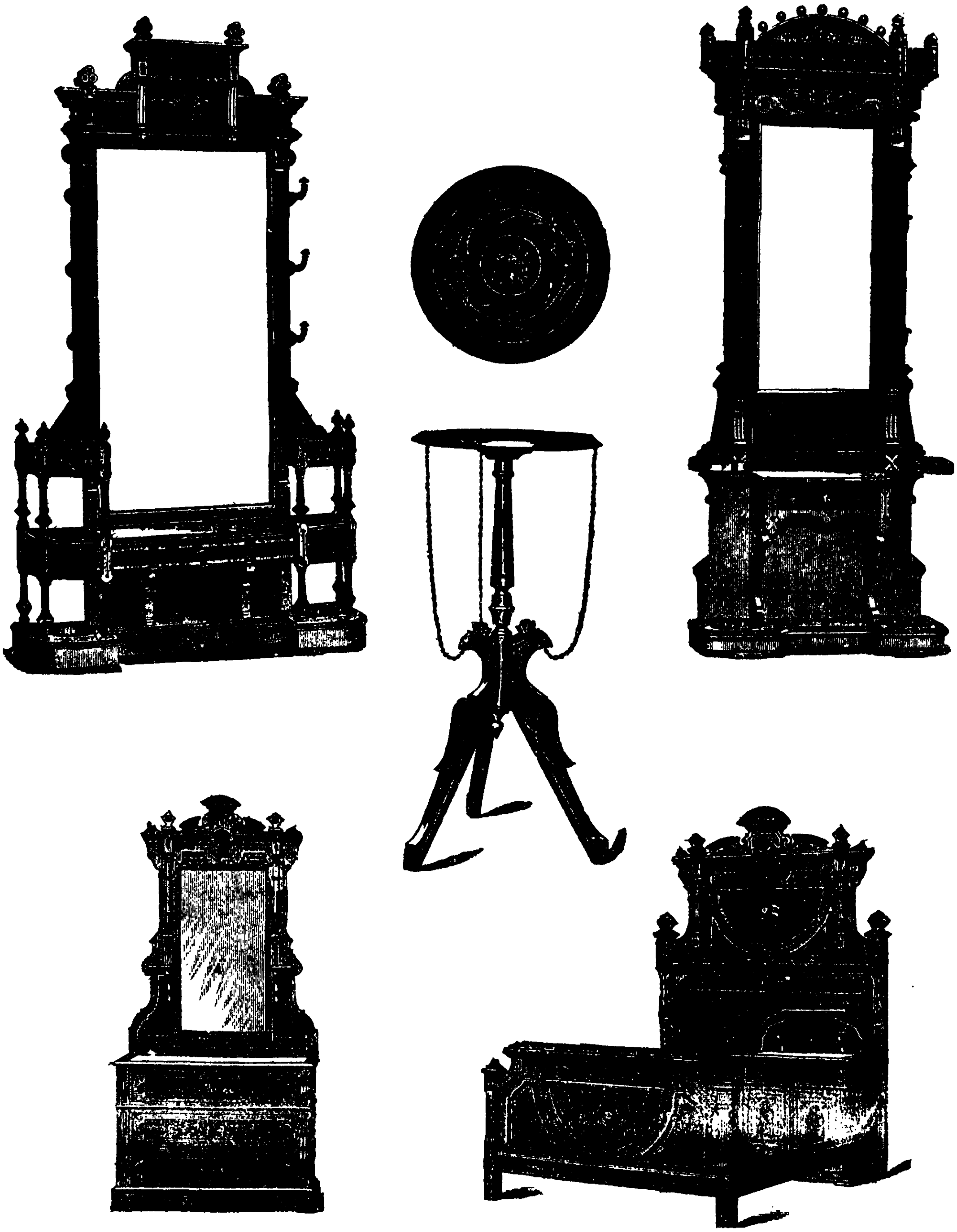
The engraving is nearly half-size; C is the check and bottom lever, as seen from the front.

WESTERN CONNECTIONS OF THE GRAND TRUNK.

The Grand Trunk Railway gets substantial aid towards securing a western connection by the sale of its Rivière du Loup branch to the Dominion government for $1,500,000 *without the rails*. The latter are iron, and need renewal, but in this country they would probably be worth $250,000 simply as old rails.

The sale is a good one, for this line has often not paid the cost of working it, and though the completion of the Intercolonial to a connection with it has largely increased its traffic (it is the sole Western connection of the Intercolonial), the profits still are, and are likely to remain, trifling. The Government buys in order to complete its road to Quebec, instead of leaving it as now with its terminus at a little village on the St. Lawrence, and with no source of traffic from the West in its own control. But the chief reason for purchasing seems to have been to aid the Grand Trunk in getting control of a road to Chicago or other Western city. Substantially, by this roundabout way, the Dominion of Canada is to buy or build a road in the United States, not for itself, it is true, but for one of its corporations. This is more generous treatment than American corporations are in the habit of getting. Imagine the United States buying an unprofitable branch of a Minnesota road on condition that the money should be spent in building a line to Manitoba for the avowed purpose of competing with Canadian roads already built! It is true that the Canadian Government does not require in terms that the purchase money should be spent for a railroad to Chicago, the terms being, "That payment for the purchase money shall only be made to cover the expenditure for such purposes in connection with the Grand Trunk Railway as the Government shall consider conducive to the public interest;" but the western connection is what the company wanted the money for and what the Canadian Parliament expects it to be used for.

This gives the Grand Trunk a great advantage over the Great Western. It is now in a measure compelled to get a Western connection and does not so much need the help of the other great Canadian company in securing it. If it can command the Port Huron & Lake Michigan and the old Peninsular, without making further expenditures, the $1,500,000 will probably pay the whole cost of a new line between Flint and Lansing to unite them and also of the road from Valparaiso, Ind., to the Chicago Southern, which will give an independent entrance into Chicago. If these be made and a new line be built from Toledo to Detroit to connect the Wabash and the Grand Trunk, then some 150 miles of railroad will be constructed, all duplications of existing lines, and adding nothing whatever to the railroad facilities of the country, but serving solely to enable one company to compete with others to better advantage. Indeed, so far as the cost of conducting traffic is concerned, it would be better to throw the money they will cost into the sea, rather than build these roads with it; for it would certainly be cheaper to carry all the traffic on the existing roads than to divide it between them and another. It may be the best thing for the Grand Trunk to do, and it is barely possible that shippers may profit by it; though that is not probable, for when the Grand Trunk gets its road it will want to make something out of it, and it certainly cannot if rates are lower than they have been of late years. But for the community at large such an expenditure is a pure waste, and it is not creditable to our civilization that we have not found some means of preventing such wastes. It will not be so serious in this case, doubtless, as in many others that might be named, but it is peculiarly striking because all the road in the lines described will be directly alongside of existing roads, so that there can be no new facilities worth the mention given for local traffic. The new lines will have no through traffic and no local traffic which they do not take from other roads.



FURNITURE DESIGNS.

Workshop Notes.

To Remove Rust from Iron.—The easiest method of removing rust from iron is rubbing it with a rag dipped in oil of tartar. The rust will disappear immediately.

Plumbers' Solder.—One part of bismuth, 5 parts of lead, and 2 parts of tin form a compound of great importance in the arts.

To Make a Cement of a Mahogany Color.—Take 2 oz. of beeswax, and ½ oz. of rosin, melt them together ; then add ½ oz. Indian red, and a small quantity of yellow ochre, to bring the whole to the desired color. Preserve in a pipkin for use.

To Make Brass.—Place in an earthe crucible a portion of copper filings, mixed with about twice its quantity of finely granulated zinc ; cover the whole with charcoal powder, press it well together, and then expose it to the action of a clear fire for some time, the two metals will then combine and form brass.

To Remove Fusel Oil and Clarify Liquors.—A powder is prepared consisting of 30 parts of pure starch, 150 parts of powdered albumen, and 15 parts of sugar of milk. About 7 ozs. of this powder will be sufficient for 2 gallons of liquor, which, when well shaken and allowed to stand for settling, may be decanted free from fusel oil and perfectly clear.

Chipping Chisels will be found to stand best when not hammered (in the forging) after the steel has lost its red heat. The forging on the edge should be done first so that the steel shall give way to the blows without becoming partly disintegrated. The finishing blows should be light ones.

Flat Drills.—The greatest fault prevalent in the use of flat drills is that of having them too thick at the point where the cutting edge is necessarily a very dull one, and has to be forced heavily to make it cut at all. It is a good plan to thin the point by beveling off the flat face on one side.

Turning Grindstones.—The best thing to turn up a grindstone with is a piece of gas pipe used as a turning tool, using a piece of iron clamped to the face of the grindstone trough so as to form a rest or support for the gas pipe. The stone should be turned when dry and the face beveled off after it is true with a piece of thin sheet iron.

Brass Solder for Iron.—Melt the plates of brass between the pieces that are to be joined. When the work is very fine the parts to be brazed should be covered with powdered borax, melted with water so that it may mix with the brass powder which is to be added to it. Expose the piece to a clear fire in such a manner that it shall not touch the coals, and let it remain till the brass begins to run.

Cast-Steel.—If a piece of cast-steel be made red hot and is quenched in cold water it will become longer, but if the same operation be performed upon a piece of wrought-iron it will become shorter. The precise amount of the alteration, or its variation in different qualities of each metal, has never been determined, although it is of great importance in workshop manipulation.

Lead Explosions.—Many mechanics have had their patience sorely tried when pouring lead around a damp or wet joint, to find it explode, blow out, or scatter, from the effects of steam generated by the heat of the lead. The whole trouble may be stopped by putting a piece of rosin, the size of the end of a man's thumb, into the ladle and allowing it to melt before pouring.

Speed of Elevators.—It is not necessary that the speed of an elevator should be in proportion to the diameter of the pulley. The proper speed with a pulley of one size is the proper speed for the elevator with a pulley of any size. Elevators work well at very diverse rates of speed, and hence the fact that the fallacy of giving them speed proportionate to the size of the pulley has been so frequently overlooked.

Diameter, etc., of Wheels.—The diameter of a toothed wheel may be found by multiplying the number of teeth by the true pitch and the product by ·3184. The result will give the diameter between the pitch line on one side and the same line on the other side. To compute the number of teeth in a pinion to have any given velocity, multiply the velocity or number of revolutions of the driver by its number of teeth or its diameter, and divide the product by the desired number of revolutions of the pinion or driver.

Cement.—Mons. Pollock, of Saxony, has invented a cement, composed of pure oxide of lead and concentrated glycerine, which is adapted for cementing both iron and woodwork. The mixture is insoluble in acids, hardens quickly, and is not influenced by heat. When this compound is used, and after it has become properly hardened, it is more easy to break the solid stone than to separate the parts thus cemented.

Gilt Lettering on Leather.—The leather is covered with white of egg where the lettering is to be done. A leaf of gold is laid on, and the letter punches heated over gas are picked up and pressed gently on the leather in order. The remainder of the gold leaf is then brushed off by a camel hair pencil.

German-silver is composed of one part of nickel, one part of spelter of zinc, and three parts of cooper ; but all these substances have to be pure, and must be exposed to a great degree of heat before they will unite. German-silver prepared from pure metal will equalize in whiteness sterling silver, and will not tarnish.

Turpentine varnish may be compounded as follows : Mastic in tears, 12 ozs. ; pounded glass, 5 ozs. ; camphor, ½ oz. ; oil of turpentine, 1 quart ; digest with agitation until dissolved ; then add Venice turpentine (previously liquified by a gentle heat), 1½ oz. Mix well and decant it from the wood the next day.

In bronzing plaster statues the powder is dusted over the statue while it is yet sticky from a coating of turpentine varnish. The best way is first to give a few coats of alcoholic shellac varnish, and then the coating of turpentine varnish, as otherwise the latter is too quickly absorbed. Let it stand till half dry and sticky, and then dust over any color of bronze-powder to suit the taste.

Universal Cement.—Curdle skim-milk with rennet or vinegar, press out the whey, and dry the curd at a gentle heat as rapidly as possible. When quite dry reduce to a very fine powder. Then take the powdered curd 10 drachms ; powdered quicklime, 1 drachm ; powdered camphor, 8 grains ; mix ; keep in tightly-corked phials. To join glass, earthenware, etc., the powder is made into a paste with a little warm water, and applied immediately.

A German periodical is responsible for the following method of making malleable brass : Thirty-three parts of copper and twenty-five of zinc are alloyed, the copper being first put into the crucible, which is loosely covered. As soon as the copper is melted, zinc, purified by sulphur, is added. The alloy is then cast into moulding sand in the shape of bars, which, when still hot, will be found to be malleable and capable of being brought into any shape without showing cracks.

Black Finish for Brass.—Optical and philosophical instruments made in France often have all their brass surfaces of a fine dead black color, very permanent and difficult to imitate. The following, obtained from a foreign source, is the process used by the French artisans : Make a strong solution of nitrate of silver in one dish and of nitrate of copper in another. Mix the two together and plunge the brass into it. Remove and heat the brass evenly until the required degree of dead blackness is obtained.

Cement for Joining Metals with Non-Metallic Substances.—To obtain a cement suitable for joining metals and non-metallic substances, mix liquid glue with a sufficient quantity of wood-ashes to form a thick mass. The ashes should be added in small quantities to the glue while boiling and constantly stirred. A sort of mastic is thus obtained, which, applied hot to the two surfaces that are to be joined, make them adhere firmly together. A similar substance may be prepared by dissolving in boiling water 2½ lbs. of glue and 2 ozs. of gum ammoniac, adding in small quantities about 2 ozs. of sulphuric acid.

Cement for Fixing Metal Letters on Glass Windows.—Copal varnish, 15 parts, drying oil 5 parts, turpentine 3 parts, oil of turpentine 2 parts, liquified marine glue 5 parts. Melt in a water bath, and add 10 parts dry slacked lime.

Zinc plates expand and contract strongly under the influence of change in the temperature, and become quite brittle in the cold. Zinc, therefore, must be allowed plenty of play room. It should be attached either with nails of zinc or of strongly galvanized iron, as iron nails will rapidly rust out.

Care of Boilers.—Whenever the water in a boiler becomes dangerously low, the attendant should immediately draw the fire and allow the boiler to cool. He should not admit any cold water to the boiler, or attempt to raise the safety valve, as this is a dangerous proceeding. It lessens the pressure by allowing the steam to escape from the boiler and thus permits the water to rise and come in contact with the over-heated iron. Probably many explosions have been caused in this way.

Protection from moisture, even that of air, is very essential for the preservation of cements as well as of quicklime. On this account the barrels are generally lined with stout paper. With this precaution, aided by keeping the barrels stored in a dry place, raised above the ground, the cement, although it may require more time to set, will not otherwise very appreciably deteriorate for six months; but after fourteen or sixteen months, Gilmore says it is unfit for use in important works. But in lumps kept dry, it will remain good for two or three years, and may be ground as required for use.—*Trautwine.*

STEAM TIGHT JOINT.—Mix boiled linseed oil and white lead to a proper consistency, always using the larger portion of white lead. This composition may be applied to a piece of flannel and fitted to the joint. A more powerful cement for withstanding the action of steam is composed in the proportion of 2 ozs. of sal-ammoniac and 4 ozs. of sulphur, made into a stiff paste with a little water. When the cement is wanted for use dissolve a portion of the paste in water rendered slightly acid, and add a quantity of iron turnings or filings, sifted or powdered to render the particles of uniform size. This mixture, put into the interstices of iron work, will in a short time become as hard as stone. From experience it is ascertained that more depends upon calking the joints than in mixing the cement.

ARTISTIC BRICKWORK.

THE MORSE BUILDING.

A building has been erected recently upon the corner of Nassau and Beekman streets, New York, which in many respects attracts more than passing notice. It is known as the Morse Building, and stands upon the site of the old Park Hotel. Although there have been many tall buildings erected in New York of late years, this one outstrips them all. It is the highest sheer brick wall now standing in the city. But it is not its height alone that attracts attention. There is a display of ornamental brickwork in its walls which, in its arrangement and effect, is very pleasing to the eye of the observer. The features of construction embodied in the building throughout are very striking, and the largest measure of convenience and taste in appointments has been obtained at the expenditure of a very moderate sum of money; besides, the building is fire-proof throughout.

The features of this structure to which we particularly desire to call the attention of our readers, and a description of which we believe will be of practical use to them, lie in the peculiar use and treatment of brickwork. The accompaning engravings, which have been especially prepared for this article, serve to illustrate these points. Fig. 1 shows the principal, or Nassau street, elevation, while the other cuts represent details of the several stories and of the individual bricks employed.

Believing the building itself to be of interest to our readers, not excepting those who are situated at a distance from New York, we will attempt a general description of the structure, in connection with the special features of brick construction and decoration already referred to.

The architectural problem set by the owners was a very difficult one. With a frontage of some 85 feet on Nassau street and some 69 feet on Beekman street, they insisted upon a structure of eight stories, exclusive of the basement. It was to be fire-proof, and economy of construction was to be considered throughout.

The architects selected for the purpose of carrying out these ideas were Messrs. Silliman & Farnsworth, of New York, and that they have made a success is clearly indicated by the building they have produced. They set out to design a structure which should be as effective artistically as possible, which should be entirely appropriate and thoroughly adapted to the purpose for which it was intended, and which should involve the expenditure of the least amount of money. The result accomplished speaks for itself.

It was decided that the use of cast iron in a constructed fashion was to be avoided. No material which was simply decorative in character was to be employed, but whatever features of ornamentation were necessary should be obtained from the materials of which the structure was built. The lessons of the great Chicago and Boston fires, which clearly demonstrated that brick construction affords the greatest measure of safety against a conflagration, were remembered, and brick was selected as the leading material for the edifice.

The chief point of interest in brickwork is, of course, the arch, and the architects accordingly attempted to vary the form of the arch and the details in a way that should bring out, in the most satisfactory manner, the peculiar properties of brick as distinguished from other building material. The question which arose in the consideration of the design were, first, the general mass; second, the forms of the openings of the windows and style of the cornice, and third, the details.

The general form of the building was necessarily determined by the purpose for which it is to be used—that of offices—and one story had to conform to another. To obtain variety, therefore, strong lines of piers were projected, throwing the building into bays, and these bays in turn were treated from story to story in such a way as to keep the horizontal lines as strongly marked as possible, in order to overcome as much as might be the excessive height to which the building was obliged to be carried.

It was believed by the designers that, if they could succeed in obtaining enough light and shade upon the building, a brick building would be made as satisfactory and as pleasing to the eye as a stone building, or one constructed from any other material. They therefore studied to obtain strong shadows in the front entrance archway, in the window openings and along the sides of the main piers. These may be considered primary shadows. Secondary shadows were obtained by the *projecting and receding* of the bricks in the arch heads of the window openings and in the front entrance.

By examination of the elevation, the reader will see just how the front was divided by the piers, as above described, and how prominence was given to horizontal lines in the shape of belt courses, sills, &c. The details show the methods employed for what we have termed the secondary shadows, and in part those for the primary shadows. The requirements for these various purposes were happily blended in the general composition.

In the basement heavy segmental arches were employed between the main piers, and the latter, in turn, were battered to assist in giving a strong and substantial appearance to the structure. In the first story large semi-circular arches—of about 8-foot openings—were used, which were treated very boldly in all their arch lines. Above these, again, semi-circular openings of about half the width were employed, and then for the next two stories the openings were grouped together in the form of segmental arches. The same order was then repeated, commencing with the semi-circular arches in the fifth story and finishing with the same in the eighth, which in turn was surmounted by the cornice.

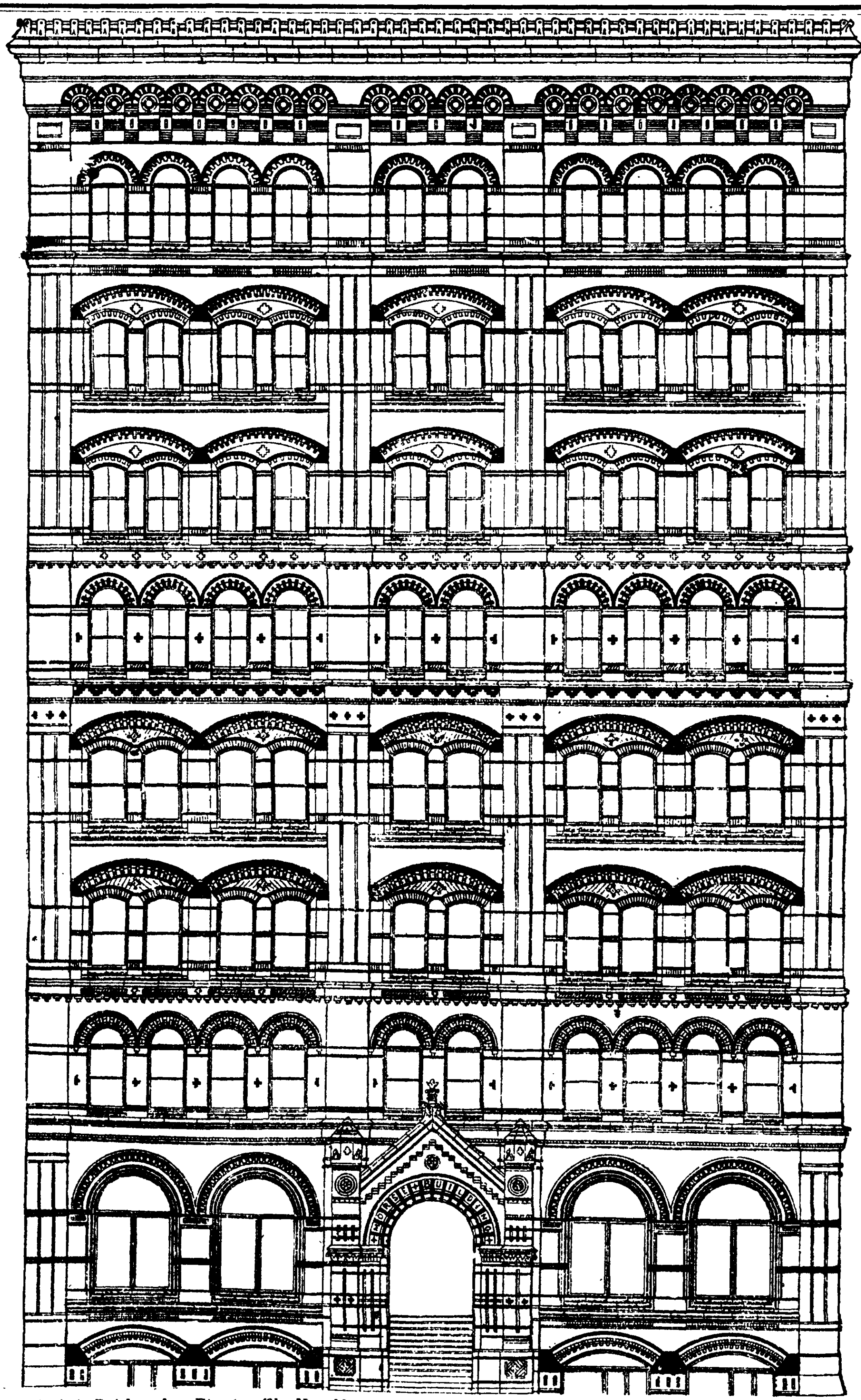
The cornice, a detail of which is shown in Fig. 2, was designed in terra-cotta, with bold projections standing upon corbels of brickwork. The capping member of the cornice presents a serrated sky-line.

As will be seen by examination of the details, molded brick was freely used throughout the building—in the arch heads, string-courses, corbels and other ornamental portions, and much of the pleasing variety of detail which the structure presents is due to the employment of molded brick. The only contrasts in color were obtained by the use of black brick. The latter were colored by dipping in coal tar while hot, and from day to day, during the progress of the building, as required for use.

The molded bricks employed were of the shapes shown in the diagrams accompanying our details, and the numbers of which correspond to the numbers inserted in the details. They were selected from the regular stock patterns of the Peerless Brick Company, of Philadelphia, concerning whose products we shall have more to say further on. Nearly 3,000,000 common brick were consumed in the building and about 150,000 pressed brick, some 15,000 of the latter being molded brick.

(*To be continued.*)

HEPTANE.—Six or seven years ago abietene, a hydrocarbon obtained by distilling the exudation of the nut pine or digger's pine of California (*Pinus sabiana*), was introduced in market and sold in a crude state under various names, and is now used for removing grease spots, etc. It is aromatic, colorless, and very liquid. Chemists lately made a pretty thorough chemical and physical examination of this abietene, and found it to consist mainly of pure heptane—a substance the other known natural sources of which are petroleum and fossil fish oil. The occurrence of a paraffine playing the part of oil of turpentine in a tree now living is exceedingly interesting. In ordinary turpentines a paraffine-like substance has been found, but only in very small quantities. The composition of the oil of the *Pinus sabiana* probably varies at different seasons, as sometimes the nuts taste strongly of turpentine, and at other times they have hardly any of that flavor.



Artistic Brickwork.—Fig. 1.—The New Morse Building, Corner of Beekman and Nassau Streets, New York.

Scale 1-16 Inch to the foot.

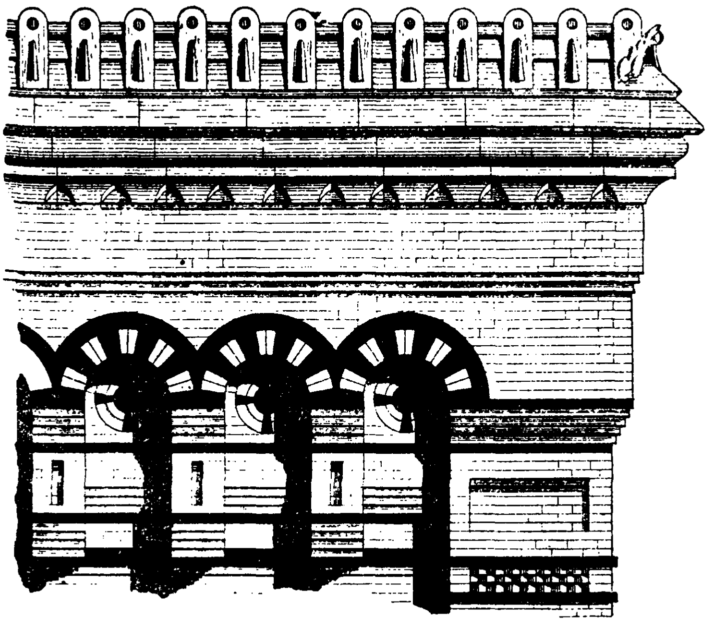


Fig. 2.—Cornice of the New Morse Building.—Scale ¼ Inch to the Foot.

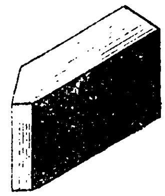


Fig. 5.—Enlarged View of Brick No. 21, in Figs. 3 and 4.

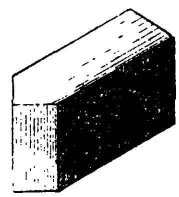
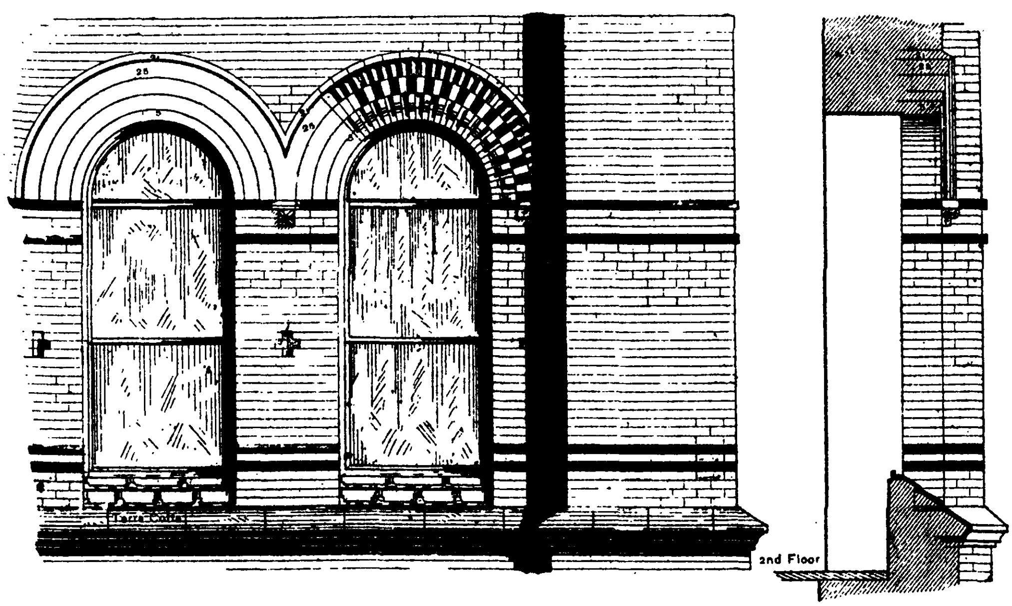


Fig. 6.—Enlarged View of Brick No. 25, in Fig. 3.



Artistic Brickwork—Fig. 3.—Detail of Second Story of the New Morse Building.—Scale ¼ Inch to the Foot.

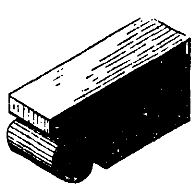


Fig. 7.—Enlarged View of Brick No. 5, in Fig. 3.

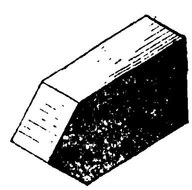


Fig. 8.—Enlarged View of Brick No. 20, in Fig. 4.

(See page 240 for fig. 4.)

"HONOUR TO WHOM HONOUR."

Nobody, we should imagine, will begrudge Sir Henry Bessemer the distinguished honour of Knighthood which Her Majesty the Queen has been graciously pleased to confer upon him—an honour which was undoubtedly his due by reason of his great services in partly originating and thoroughly developing an entirely new branch of our iron and steel industry. This recognition has been somewhat tardy, coming as it does at least twenty years after Mr. Bessemer's eminent talents had received honorary distinction from the rulers of other countries, who were sharp enough to see and generous enough to reward, in some shape, the services of a man whose position not only entitled him to rank among great inventors, but whose discoveries have so enormously benefited mankind. Other men may have thought in the same groove, and cudgelled their brains in the hope of improving modern metallurgy in some such way as Henry Bessemer, without either making money or winning honours, and if he—an inventor from his earliest years—alone and unaided, walking the path that was open to him in the wide field of scientific discovery, achieved a splendid success, surely the more honour to him. Who can say that, if Mr. Bessemer had been effectually discouraged by the enormous difficulties which surrounded his tentative experiments, any other man was certain of success?

Let it not be forgotten that the methods for producing steel now universally known as the "Bessemer process" were originally received with incredulity and derision. Mr. Bessemer's discoveries, although based on principles well known to scientific men, were on their first announcement held to be wholly untrustworthy by practical iron manufacturers, who were acquainted with malleable iron only as a solid substance, which the highest heat of their most powerful furnaces merely sufficed to render sufficiently soft to yield to the blows of the hammer; and for this reason the proposal to convert molten pig iron into fluid malleable iron, in a few minutes, and without the consumption of additional fuel, was considered an absolutely impossible feat. To the genius and unwearied perseverence of Mr. Bessemer we owe the combinations of chemistry and mechanics which, long after they had overcome the obstacles of nature, obtained a slower and more difficult victory over the prejudices of habit and ignorance. Our metallurgical pioneer was indebted to no one for his facts—they were the common property of every practical ironmaster; and after all his conclusions were abundantly verified by his own experiments. Previous to his discoveries being made public, many of the facts which he made the foundation of his invention were deemed of no importance. Any one who has watched the process of forged horse-shoe nail-making in any of the little Staffordshire smithies, will have noticed a small pair of bellows in front of the workman's block used for forcing a blast of air upon the heated rod of iron that is being hammered on the anvil. This illustrates one of Mr. Bessemer's facts. He was the first to show that if air was forced, not upon the surface merely, but into and amongst the particles of molten iron, the same sort of combustion took place; and the heat obtained in this way is more intense than any that had been used previously, either in the blast furnace or the process of puddling. We need not trace the connection between this application of air to molten iron and the process of decarburisation which it brings about, or refer more particularly to the combinations which take place in the puddling furnace between the oxides of iron and the carbon at high temperatures, or of Mr. Bessemer's patent process of removing the carbon from the iron by the act of burning it with oxygen at a high temperature. It is in this patent, however, that we find reference made to the appliances specified in previous patents, and taken in combination, there is a complete embodiment of the essential elements of Mr. Bessemer's invention.

This faintly indicates the character of our great inventor's investigations, in the course of which he has expended not only many years of labour, but large sums of money upon the apparatus needed for them. We prefer to deal with results. Sir Henry Bessemer has increased the national wealth enormously by his process of converting crude iron into steel, thus giving employment to thousands of workmen, and putting in motion wheels in industrial production that would otherwise be at rest. In the matter of railway material it is estimated that the substitution of Bessemer steel for iron will produce a saving of expenditure during the life of one set of steel rails on all the existing lines of the United Kingdom of more than one hundred and seventy millions sterling. The great growth of the steel trade is undoubtedly due to the man whose name will ever be indelibly associated with the history of English metallurgy. Prior to his invention, the entire production of cast steel in Great Britain was only about 50,000 tons annually, and its average price from £50 to £60 per ton. In the year 1877, notwithstanding the depression of trade, the Bessemer steel produced in Great Britain alone amounted to 750,600 tons, while the selling price averaged only £10 per ton, and the coal consumed in producing it was less by 3,500,000 tons than would have been required in order to make the same quantity of steel by the old, or Sheffield, process. The total reduction of cost is equal to about £30,000,000 sterling upon the quantity manufactured in England during the year. During the same year the Bessemer steel manufactured in the United States, Belgium, Germany, France, and Sweden raised the total output to 1,874,278 tons, with a net selling value of about £20,000,000 sterling.

It is not to be wondered at that under the circumstances the term "Bessemer metal" has become current in most of the languages of civilised communities. Sir Henry Bessemer may be proud of the honorary distinctions showered upon him, but he has added to his courtesy titles the more substantial rewards of a successful inventor in the commercial appreciation of his discoveries. Few inventors have made money so rapidly and continuously, and none perhaps have had less reason to complain of the hardships of our anomalous patent laws than Sir Henry Bessemer, for he quaintly acknowledges the receipt of royalties amounting "to no less than 1,057,748 of the beautiful little gold medals which are issued by the Royal Mint with the benign features of her Most Gracious Majesty duly stamped upon them." Is there no hope for the poor inventor?—*Martineau & Smith's Hardware Trade Journal.*

Mechanical.

MOLDS AND CORES FOR CASTING STEEL.

Steel made by the open hearth furnace comes therefrom very much hotter than when melted by any other known process; Mr. George Cowing, of Cleveland, Ohio, has, therefore, been induced to invent an improved mode of casting. It is on account of this intense heat of the molten steel that difficulties have arisen in casting, as the contact of the steel with the walls of the mold fuses the material of the mold and forms a flux or scoria that coats the casting and is difficult to remove. This effect takes place with all materials that have been heretofore used for molds. Common sand, plumbago, charcoal, coke, and other materials have been tried, but the foreign matters contained in these substances are of such a nature that the successful prevention of flux or scoria has not been heretofore accomplished. The object of his invention is to construct a mold from a substance that is adapted for ordinary use as molding material and possesses refractory qualities sufficient to successfully resist the tendency to flux when brought in contact with the hottest molten steel. According to his invention, silica is used in the construction of molds for this purpose, as it has been discovered that pure silica, with suitable binding material, answers the requirements set forth, and that by its use, steel castings may be produced almost or entirely free from the flux or scoria. In proportion as the silica used for molds contains limestone, feldspar, mica, or other silicates, oxide of iron, or foreign matters of any kind, the castings will be coated as described, and sand, such as is used for molds, contains silica more or less mingled with the substances named.

This fact, without doubt, explains the reason why it has been heretofore considered impracticable to use sand molds or molds made from powdered stone, old clay pots, or like material for casting steel from an open hearth furnace. In carrying out this invention it is preferred to obtain the silica from rock crystal, white pebbles, or white sand; if white pebbles are used they should first be pulverized and thoroughly freed from oxide of iron or other foreign matters. When about to be formed into molds the silica is to be mixed with any appropriate binding material, such as molasses, sour beer, flour, or other glutinous substance, silicate of alumina, or the like, care being taken to employ no substance containing any metallic oxide, or anything that might flux. A sufficient quantity of the binding material will be mixed with the pulverized silica to form a plastic mass that can be molded, and will retain its shape after molding. An additional advantage obtained by the application of this invention is the ability to cast mild steel—*i. e.*, steel having a low percentage of carbon, which cannot be done in molds consisting of or containing plumbago, graphite, coke, or other forms of carbon without subsequent annealing. As stated before, he is aware that materials containing more or less silica have been used for molds, but in such materials the refractory qualities of silica which render it useful for the purpose are neutralized by the other materials.

HOW TO FILE AND SET A HAND-SAW.

The following instructions, although somewhat wearisome, perhaps, to the mechanic, may be of practical use to some of our readers who are removed from saw-sharpening facilities: When a saw is in bad order, the teeth are irregular in length and pitch. This occurs through improper filing, and results in the saw working hard. The reason is that a saw irregularly filed, or set, cuts only with the longest teeth and those that have the most set. To remedy these defects, it should be pointed and filed until the teeth are all of even length, and are pitched so that the front of each tooth is at right angles with the back of the saw. The saw is fastened into a clamp, which consists of a pair of jaws upon a stand, and moved by screws. The ends of the teeth are brought to a level by running a flat file lengthwise of the blade. The best form to give the edge is a slight curve from end to end of the saw, making the middle slightly rounding outward, never hollow.

The handle of the saw when in the clamp should be to the left, and not be changed during the filing. The part held in the clamp should be filed completely before being moved, if the jaws are not long enough to hold the whole. On a rip-saw, the teeth will be filed square on a cross-cut, they are beveled upon alternate sides. Both sides should be filed without moving the saw, which may be done by changing the position and manner of holding the file. A beginner should provide a handle at least a foot long for his files; this will enable him to hold it steadily, which is very necessary for good work. The proper size for a file is three and one-half inches long for a saw having eight teeth to the inch. A saw is set before it is filed. The set given for easy cutting should be such as to make the cut as wide as twice the thickness of the blade.

Several good sets are sold at the tool shops which are self-regulating, and make even work. If only a few of the teeth are short, they need not be pointed, but may be touched with a few strokes at each filing, until the rest are worn down to them. If one has no clamp, a strip of hard wood may be laid upon each side of the saw, and the whole held tightly in a vice. In filing, the strokes should be made from the operator and not towards him. The file should be grasped firmly in the right hand, while the tip is held lightly between the finger and thumb of the other. A safe rule is to work slowly, and to test the teeth as the work progresses with a try square. As long as the faces are kept at right angles with blade of the saw, the backs must come out right.

GRINDSTONES.

What can disable a machine-shop more effectually than to destroy the *grindstone*? Unless the loss were supplied by the modern substitute, the emery grinder, to destroy the grindstone would be to wreck the shop. A thorough study of the subject will develop more requirements than many think, and much ingenuity or skill in designing might be displayed in working out the problem. It should be strong, simple and clean; the trough expanded to catch as much as possible of the drip water and grit; a movable shield securely hinged to keep the water from splashing, and yet permit the stone to be used from either side; rests provided upon which to rest tools and the rod for turning the stone, these rests being arranged to move toward the centre as the stone wears smaller. The bearings should be generous in size, proper provisions being made for oiling without washing the grit into the bearings with the oil, and the ends of the bearings being protected by some device which effectually prevents the entrance of the grit. The stone should be secured to the shaft by nuts and washers, and the washers fixed so that they can not turn with the nuts as they are screwed up or unscrewed. In hanging the stone, great care should be taken to hang it true sidewise, not only for convenience in using, but because a stone that is not true sidewise can never be kept true edgewise.

Suppose a stone to run one-fourth of an inch out of true sidewise, and while in motion draw a line around it within three-eighths of an inch from the edge, on an average. From this line there would be but one-fourth of an inch of stone on one side and one-half on the other. If you had a stone only this in thickness—that is, a stone one-fourth of an inch thick on one side and one-half of an inch thick on the other—would not the one-fourth-inch side wear away faster than the other? That is exactly what it does on that side of the thick stone, only the thicker the stone and the less it is out of truth, the less it wears.

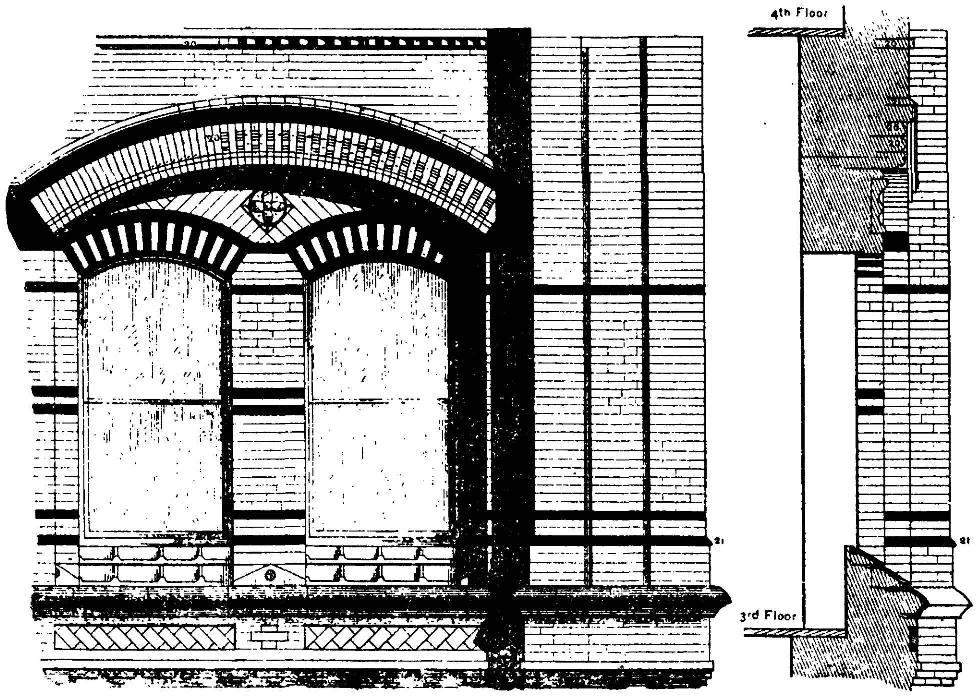
SALT IN THE MANUFACTURE OF FINISHED IRON.

The question of the best method of applying salt in the puddling process has just been discussed by the managers of the mills and forges of South Staffordshire and East Worcestershire at a numerously attended meeting of their associations under the presidency of Mr. Price, manager of the Brettle Lane Iron Works, Stourbridge. Members stated they had thrown dry salt upon the bottom of the puddling furnace before the charge was put in, and upon the iron as it was about coming to the boil; that they had used it as a mixture with manganese, and as a mixture with fire-clay and red ore. It had also been used in solution with water to saturate the bull-dog in the preparation of the fettling, and its use in solution adopted by Messrs. Nettleford was also spoken of. The quantity of salt used varied in nearly every case. As much as four pounds of dry salt had been thrown upon lean iron beginning to thicken, and the result was that the iron boiled fluid; when shingled, was hard like steel; when broken as a bar, was highly crystalline; and after being piled, re-heated and drawn out through the rolls, was very brittle. Thrown upon the furnace-bottom salt benefited the fettling. Used as a "physic" with manganese in iron for sheets it was found of advantage, since the bars were clear, and when rolled out the sheets had a good surface. In getting up lean and soft iron for sheets it was found of especial advantage as a hardener. The mixture was deemed good for steel iron. Mr. Jeremiah Jones, manager of the Terry Hill works, had with advantage used dry salt and manganese, in the proportion of two pounds of the former to three ounces o. the latter, in the manufacture of iron for sheets. Salt mixed with fire-clay and red ore and thrown on the bottom of the furnace had been found by Mr. William Farnworth, manager of Messrs. E. P. and W. Baldwin's works, to harden the sheet-iron, and give the sheets a dry surface.

Mr. Farnworth had also experienced good results from throwing cold water on the iron while it was in the furnace. As to the application of salt and water upon the patented method of Mr. Barnett, Mr. Ellis, manager of the Primrose Hill Iron Works, said that he had tried it under Mr. Barnett's directions: One pound to one and one-half pounds of salt were dissolved in a quart of water, and more water was afterwards added. This solution was applied to a furnace for a fortnight with the result that it improved the fettling and the bottoms. The patentee's charge was, however, for his method of application, too expensive, and it was not continued. Mr. Cresswell, mill and forge manager at the Earl of Dudley's works, had employed the solution on Mr. Barnett's principle for some months. He used about as much salt as had been used at the Primrose Hill Iron Works. It had been employed in a single furnace and in a double gas furnace, and the results were the more satisfactory from the gas furnace. A comparison of the yield of a gas furnace worked without the solution and of one worked with it showed a larger yield by one quarter and a few pounds from the latter. The bulldog was saturated with the brine, about one gallon was poured on the double furnace bottom, and when the charge began to thicken about five quarts was put in on each side of the double furnace. One furnace had been worked throughout a whole week, and no scrap ball had to be used. Mr. Cresswell had known one fettling stand nine heats.

After hearing these and other similar experiences, the meeting was of opinion that where hard steely iron was required the application of salt in solution was beneficial, but where pliable and ductile iron was needed, salt should not be used. The information received was not, however, considered to be complete, and the further discussion of the subject was adjourned till after the annual trip of the association, which will be taken at the close of May, to the Castle Iron Works of Messrs. Nettleford, in Shropshire, where the patented method is working successfully.—*Wolverhampton (England) Chronicle.*

EXTRAORDINARY PRODUCTION OF STEEL RAILS AT DRONFIELD.—An extraordinary output of steel rails has been made at the works of Messrs. Wilson and Cammell, Dronfield, for two weeks ending Saturday, May 17. The actual quantity of rails produced was 4,656 tons 18 cwt., being the production for each week as follows.—For the week ending May 10th, during which the time of working was ten shifts, 2,256 tons 7 cwt.; and for the week ending May 17th, during which eleven shifts were made, 2,400 tons 11 cwt. This enormous output is said to be the largest in the world. Leaving out meal times, the quantity of rails rolled is 1 ton in every 47 seconds of the time worked.

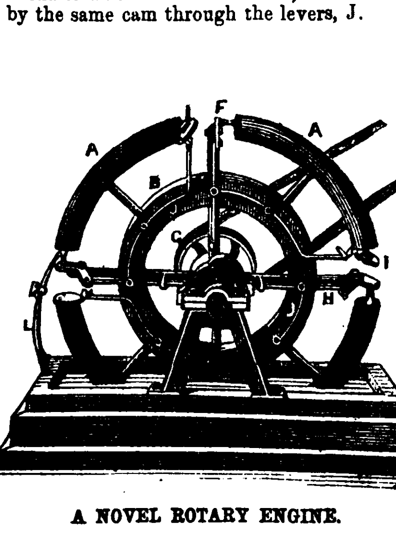


Artistic Brickwork.—Fig. 4.—Detail of Third Story of the New Morse Building.—Scale ¼ Inch to the Foot.

A NOVEL ROTARY ENGINE.

We give herewith an illustration of a rotary engine of novel character, which the inventor, Mr. Lorenzo B. Lawrence, of Monticello, Cal., calls a rotary vacuum engine. It consists in an arrangement of curved tubes, A, which are open at both ends, and supported by a wheel, B, secured to a hollow shaft, and having tubular spokes, which project beyond the periphery of the wheel into the spaces between the curved tubes, A.

The hollow shaft is supported by plummer blocks, which rest upon the sides of a water tank, into which the curved tubes dip. One end of each curved tube is always left open; the opposite end is provided with a valve, I, which closes automatically as the open end touches the water. Opposite the open end of each curved tube there is a gas-burner, F, which is pivoted to one of the tubular arms of the wheel, B, and is moved by a cam, G, attached to the plummer block. This burner receives gas through the hollow shafts and arms of the wheel, B. The valves, I, are operated by the same cam through the levers, J.



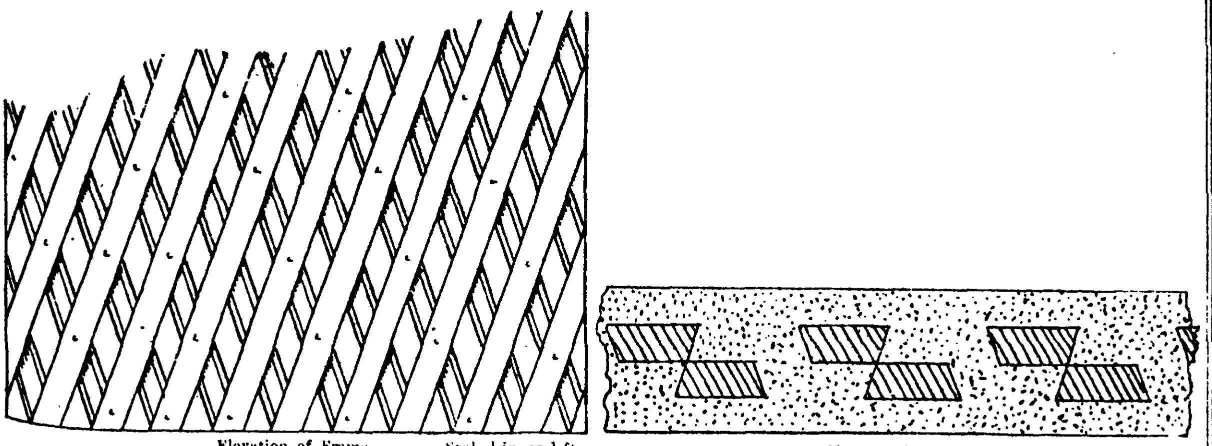
A NOVEL ROTARY ENGINE.

The pivoted burners are arranged with reference to a continuously burning stationary gas jet L, so that the gas is let on as they come opposite the stationary jet, the latter serving to ignite the gas as it issues from the pivoted gas-burners.

As the mouth of the curved tube nears the water, the valve, I, is closed, and the burner, F, is turned aside, shutting off the gas supply. By the heat of the gas flame the air is rarefied in the tube, B, and as the tube strikes the water, the air is cooled, forming a partial vacuum, which draws the water into the tube, causing that side of the wheel to preponderate, and inducing a rotary motion, which is continued so long as the gas is supplied and ignited in the manner described.

CUTTING GLASS.

For cutting flat glass, such as window-panes, and for cutting rounds or ovals out of flat glass, the diamond is the best tool, and if the operator has no diamond it will always pay to carry the job to a glazier rather than waste time and make a poor job by other and inferior means. When, however, it is required to cut off a very little from a circle or oval, the diamond is not available, except in very skilful hands. In this case a pair of pliers softened by heating, or very dull scissors, is the best tool, and the cutting is best performed under water. A little practice will enable the operator to shape a small round or oval with great rapidity, ease and precision. When bottles or flasks are to be cut, the diamond is still the best tool in skilful hands; but ordinary operators will succeed best with pastiles, or a red-hot poker with a pointed end. The latter is preferred, as being the most easily obtained and the most efficient; and there is no difficulty in cutting off broken flasks so as to make dishes, or to carry a cut spirally round a long bottle so as to cut it into the form of a cork-screw. And, when so cut, glass exhibits considerable elasticity, and the spiral may be elongated like a ringlet. The process is very simple. The line of the cut should be marked by chalk or by pasting a thin strip of paper alongside of it; then make a file mark to commence the cut: apply the hot iron and a crack will start; and this crack will follow the iron wherever we choose to lead it. In this way jars are easily made out of old bottles, and broken vessels of different kinds may also be cut into the most intricate and elegant forms. The red-hot iron is far superior to strings wet with turpentine, friction, etc.



Elevation of Frame. Scale 1 in. = 1 ft. Horizontal Section. Scale 3 in. = 1 ft.

FIRE-PROOF PARTITION.

FIRE-PROOF PARTITIONS.

We give the following remarks on fire-proof partitions, by Major-General Meigs, U. S. A., as well as the note by the editors of the *American Architect*. Our own experience has been that the action of the lime in the plaster neutralizes the acid in green wood when the wood is not very large, and thus destroys the principal cause of dry rot. We have never seen dry rot in an old partition :—

To the Editor of the American Architect.

DEAR SIR,—You publish, from time to time, notes on fire-proof construction. I have in my practice for some years used a cheap and effective fire-proof partition, instead of the ordinary stud, lath and plaster partition, which in construction has many flues through which drafts carry fire rapidly all over a house. It costs little if any more than the common inflammable partition, and is practically fire-proof.

The skeleton of this partition is made of strips of sawed lumber about from ⅞ by 1½ to 1¼ by 2 inches. They are set up as a lattice partition, leaving long lozenge openings like the meshes of a net, which should not generally be more than 2 inches wide. The common plaster mortar is spread on one side, and when this is set the other side is plastered. The key is good, for the two coats of mortar unite. The wood, which is a narrow strip, is perfectly imbedded in the mortar so that it cannot be burned, even by exposure for a considerable time to a hot fire. There are no flues to carry fire to the top of the building into the roofs and floors. While the two diagonal sets of wooden strips should be firmly nailed, fewer nails are consumed than in securing laths on the upright studs in common use. It is well to place the strips at an angle with the vertical, of about 20°, *i. e.*, between 45° and the vertical. It is also well, though not absolutely necessary, to cut the strips of trapezoidal form, and to place them with their mortar sides to the outside of the partition. Thus each strip acts as a key to hold the plaster.

These partitions are very stiff when finished in hard finish. For upper rooms ⅞-inch lumber is sufficient; for lower rooms, which carry the weight of floors above, 1¼-inch is stiff enough. A partition of ⅞-inch stuff will be about three inches thick, or of five-quarter stuff 3½ inches thick, which effects an economy of space in a house, enlarging the rooms without weakening the partitions, which are usually not less than six inches thick.

Very respectfully your obedient servant,
M. C. MEIGS, Quartermaster-General,
Bvt. Major-General, U. S. A.

[The partition here described will commend itself at once for its fire-resisting quality, and ought to be as much a barrier to sound as the ordinary partition. Of its lateral stiffness, as to which we should have had some misgiving, General Meigs's testimony is decisive; and it must have considerable vertical strength, so as to sustain itself unsupported, without further trussing, unless pierced or heavily loaded. We should have fears, nevertheless, for its serviceableness in permanent constructions, on account of the danger of dry-rot, which would make it treacherous, and might destroy its strength in a few years.—*Ed. American Architect.*]

A NOVEL BIRD BOX.

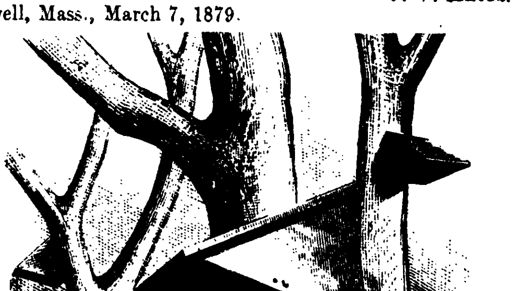
A correspondent of the *Scientific American* says :—

I have made some bird boxes for my trees that are so unique and simple that I have thought it worth while to give your readers the benefit of a description of them. I hope, in the interest of the birds, you will think as I do.

They are made of half-inch white pine, and painted; they require fourteen 1⅝ finishing nails, as also two larger nails to fasten them up with. They afford the same kind of sheltered nook that birds seek.

J. V. MEIGS.

Lowell, Mass., March 7, 1879.



A NOVEL BIRD-BOX.

WESTON'S WALK.

The longest distance ever made in a six days's walking match —550 miles—was accomplished by Edward Weston, the well known pedestrian, in the contest for the championship in London, June 16-21. The best previous record was made by Weston's opponent, Brown, in April last, when he covered 542½ miles. In the last contest Brown broke down on the third day, and made, in all, only 453 miles. Weston's daily records were respectively 123, 97, 93, 77, 83, 77 miles.

CLOTHES MOTHS.—To keep furs and woollen goods from moths close wrapping in paper is enough, though a little camphor may be put into the package to keep off other insects. Any paper will do if there are no holes in it, and no openings are left for the moth to creep in. Of course, care must be taken to have the articles free from moths when put away.

New Publications.

Foundations and Foundation Walls. By George T. Powell, Architect and Civil Engineer. New York: Published by Bicknell and Comstock, 27 Warren St.

This is an excellent guide to students, being a practical explanation of the various methods of building foundation walls for all kinds of buildings, with practical illustrations of the method of constructing isolated piers, tables of the weight, materials etc., the kind of materials used, the loads sustained, and the size of walls for piers, etc., use of piles in foundations, mortars, limes and cements, concretes, stuccos, etc., Price $1.50.

The Steam Engine of the Future. By JOHN BOURNE, C.E., *Author of 'A Treatise on the Steam Engine,' 'A Catechism of the Steam Engine,' &c.* London: Published by J. BOURNE & Co., 66 Mark Lane. Price: One shilling sterling.

We have here an outline of impending improvements in the steam engine, designed to render that great instrument of civilization far more widely useful, and far more generally accessible, than has been the case in its past history. The Author, who is no novice in such enquiries, is enabled, by tracing the lines of improvement which have been followed in the past, to deduce their position in the future. He shows that whereas thirty years ago small engines were almost unknown, their employment has increased at a prodigious and still accelerating pace; that the tendency in all factories is to displace the great central engine heretofore in use in favour of a number of small engines distributed through the works, and that the rise of the electric light constitutes a new epoch in this progress, seeing that this light must be produced near the point where it is used, and must, therefore, be generated by small engines at a number of local centres. Small engines, he contends, should be of uniform design, to enable them to be manufactured by special tools, like rifles, whereby great accuracy is combined with great cheapness of production. Existing faults of design should be corrected, and the increased cheapness and superior quality thus obtained will enable the steam engine to be employed for domestic purposes, like a docile Afrite, acting as a household drudge. The structure of engine necessary to attain this universal acceptation is explained, and the exposition is well worthy of public attention.

We observe that the species of engine and boiler the author recommends has been adopted for driving Sir Joseph Whitworth & Co.'s new machine and steel works at Manchester.

Correspondence.

To the Editor of THE SCIENTIFIC CANADIAN:

Dear Sir,—Can you inform us, and many other readers of your valuable journal, of a simple rule to compute the horse-power used when that power is rented? We pay so much per horse-power, per day, and that power is supplied to us by a belt of the average thickness and tightness 4½ inches wide; some days we use less and others more, according to the amount of machinery at work, and when we have all on, the belt is almost sure to slip. The driving pulley is 22 inches and the one on our shaft is 16 inches. Your kind answer to this will much oblige

Yours, etc.,

L. & T.

[We wish practical mechanics to answer all such questions through the columns of the *Magazine;* but if not answered, we will give a reply.—EDITOR S. C.]

DISEASE GERMS.—C. Von Nagell, a Bavarian investigator, while he retains the idea that the smallest organisms, fungi, are the cause of all infectious diseases, holds that only these germs are dangerous and calculated to infect which enter our organs of respiration with the air we breathe. If Von Nagell's theory should prove true, and find general acceptance, it would be no longer necessary to trouble ourselves about the generation of products of decay in masses of liquid, as in sewers, canals, damp soil, river and spring waters. On the other side every means must be employed to prevent these fungi diffusing through the air as a result of the drying up of such decaying masses.

INSPECTION OF PLUMBING.

(From the Plumber and Sanitary Engineer.)

The action of the House of Representatives in passing a law appointing an Inspector of Plumbing for the District of Columbia is commendable, in view of the backwardness of other cities, and especially New York, in proposing and carrying through a similar enactment. We presume the efficient health officer of the District, Dr. Townshend, mainly deserves the credit of this step of progress.

An effort was made to amend the bill so that the inspector should be paid by fees collected from persons whose houses were inspected, but we are glad to say it was voted down, and provision will have to be made for payment by a salary. It is very undesirable that any public officer should be tempted to increase his labors in order to multiply his fees. The immediate effect of the fee system would be to make the public suspicious of his disinterestedness.

An official inspector of plumbing should be a man of capacity and of the strictest integrity; fearless in the discharge of his duty, and not dependent for his living upon an uncertainty.

The majority of householders and builders would undoubtedly avoid utilizing his services if they thought they could thereby escape paying a fee. But if the cost of the service was paid out of the public money, no reasonable objection could be made to it.

On the other hand, if an unscrupulous man received the appointment under the fee system he would very naturally be regarded as a "striker," and would prove to be only a burden upon the community. The service to be performed by an official inspector of plumbing is too important to allow any one to abuse the position, and we fear the fee system would surely lead to such a result.

We understand that the Journeymen Plumbers' Mutual Benefit Society are considering the advisability of petitioning the State Legislature to appoint an inspector of plumbing for New York City, and it is high time that a move was made here in this direction.

MR. W. H. BRADLEY, superintendent of the Boston sewers, in a communication to the city government some time ago, said: "The number of drains leaking under houses and into foundation walls is very large; it is almost certain to occur with every house upon made land, and is always neglected by owners and parents till it becomes insupportable, and with sickness traceable to such causes and continual discomfort prevailing, the parties most interested will wait for the city to carry out costly general measures, thinking thus to abate their private nuisances. As a rule a bad smell in a house means something wrong locally, and should be stopped in a day. The examination of house drains made by the Boston Board of Health, which aimed at the discovery of leaks by the use of strong smelling volatile oils, shows that more than one-half of the Boston drains (and the proportion would probably *not be less elsewhere) are defective from want of tightness.*

NEW UNICYCLE.—A single wheel, wherein is arranged a seat for the traveller who is to propel it, has been invented by Mr. J. Heronemus, of Emdrup, near Copenhagen. The wheel has one central rim, and to this are fixed the arms, which are (say) six or eight in number, half of them swelled, extended, or bellied out to one side, and half of them similarly to the other side, each set of arms being fixed to a nave or boss; these arms are bent out so far and the naves are so far apart that the traveller when in the sitting posture finds room in the wheel between them. The arms are by preference not arranged opposite to one another on *the two sides, but intermediately. The naves carry each a crank,* and these cranks are by connecting rods jointed to two bell-crank levers having one arm placed about upright in a position convenient to the traveller to take hold of for working them backward and forward alternately. Each bell-crank lever has its fulcrum in the seat for the traveller, which seat is hung from the naves or axles of the wheel. The seat is by preference made in scroll form, of light open worked steel plate or wirework, or partly so, and may have a part extending overhead to carry an awning to protect against dirt thrown up and against rain. From each nave there may be hung a leg serving to steady the velocipede while entering the same, but which can be thrown up out of the way when travelling. The wheel, arms, and the rim may be fitted with stiffeners or diagonals to distribute the weight or strain over the rim as much as possible.

SPONTANEOUS COMBUSTION—SOME REMARKABLE CASES AND THEIR EXPLANATION.

Mr. Cosson recently called the attention of the French Academy of Science to a singular accident that had occurred a short time previously in his laboratory. Eight days ago, said he, my laboratory became the scene of a sudden outbreak of fire. The board flooring in the neighborhood of a stove spontaneously ignited. In consequence of a similar accident, two years ago, I had caused the board in the vicinity of the stove to be replaced by a marble slab. Notwithstanding this precaution the fire broke out in the wood around the marble. The heat to which the wood was exposed at the points where it ignited was not very great; the air had only a temperature of 25°. But without doubt there had been a slow carbonization of the wood and a rapid absorption of the oxygen of the air, and in consequence a production of caloric sufficient to cause the combustion. Herein lies a danger which should be impressed on the minds of architects and builders.

This reminded M. Fye of a case of spontaneous combustion that had recently occurred at the house of a friend of his at Passy. The fire was due to the continuous action of the heat of a stove on the surrounding wood-work.

M. Dumas adduced several analogous examples, all of which he explained by that property of finely divided bodies whereby they absorb air very energetically and generate heat. In powder factories, for instance, the pulverized carbon very often ignites of itself. It is for this reason that the practice has been generally adopted of pulverizing it in conjunction with sulphur, because sulphur deprives it of the property mentioned.

In such instances as those cited, the wood deprived of its moisture by long exposure to heat becomes transformed into a substance analogous to lignite or peat. In fact, it is changed into a condition that may be compared to that of powdered wood. In this state it condenses the air and takes fire. It was thus that, on one occasion in his experience, a beam in a coach-house exposed to hot air took fire spontaneously. Sometimes in theatres the lampman's box, filled with miscellaneous oily rubbish, becomes spontaneously ignited. The greasy odds and ends contained therein condense the oxygen of the air. In manufactories where Adrianople red is applied on cotton impregnated with greasy material, spontaneous combustion takes place very often.

M. Dumas cited one more singular fact of which he was a witness in the studio of a painter. The artist had taken a piece of cotton to brush and clean his canvass. He gave the oily surface a good rubbing and put the cotton aside. Very soon the cotton ignited spontaneously.

The all-sufficient explanation of these and like cases is the fact that a minutely-divided and air-conducting substance has the capability of producing suddenly a high temperature.—*Exchange.*

ASPHALT AND TIMBER FLOORS.

A new method of laying down floors has been adopted in France, and is said to have obtained a wide application. It consists in putting down a floor, not as hitherto, on joists, but in embedding the boarding in asphalt. The new floors are used mostly for ground stories of barracks and hospitals, as well as for churches and courts of law. Pieces of oak, usually 2½ to 4 inches broad, 12 to 30 inches long, and 1 inch thick, are pressed down into a layer of hot asphalt not quite half an inch thick, in the well-known herring-bone pattern. To insure a complete adhesion of the wood to the asphalt, and obtain the smallest possible joints, the edges of the pieces of wood are planed down, bevelling toward the bottom, so that their cross section becomes wedge-like. Nails of course are not necessary, and a perfectly level surface may be given to the flooring by planing after the laying down is completed.

The advantages of this flooring, which only requires an even bed upon which to rest, are said to be the following: 1st. Damp from below and its consequence—rot, are prevented. 2nd. Floors may be cleaned quickly and with the least amount of water, insuring rapid drying. 3rd. Vermin cannot accumulate in the joints. 4th. Unhealthy exhalations from the soil cannot penetrate into living rooms; asphalt being impermeable to damp, rooms become perfectly healthy, even if they are not vaulted underneath. In buildings consisting of several stories, as in hospitals, the vitiated air of the lower rooms cannot ascend, an object which it has hitherto been impossible to attain by any other means. 5th. The layer of asphalt will also prevent the spreading of fire from one floor to another in case of conflagration.

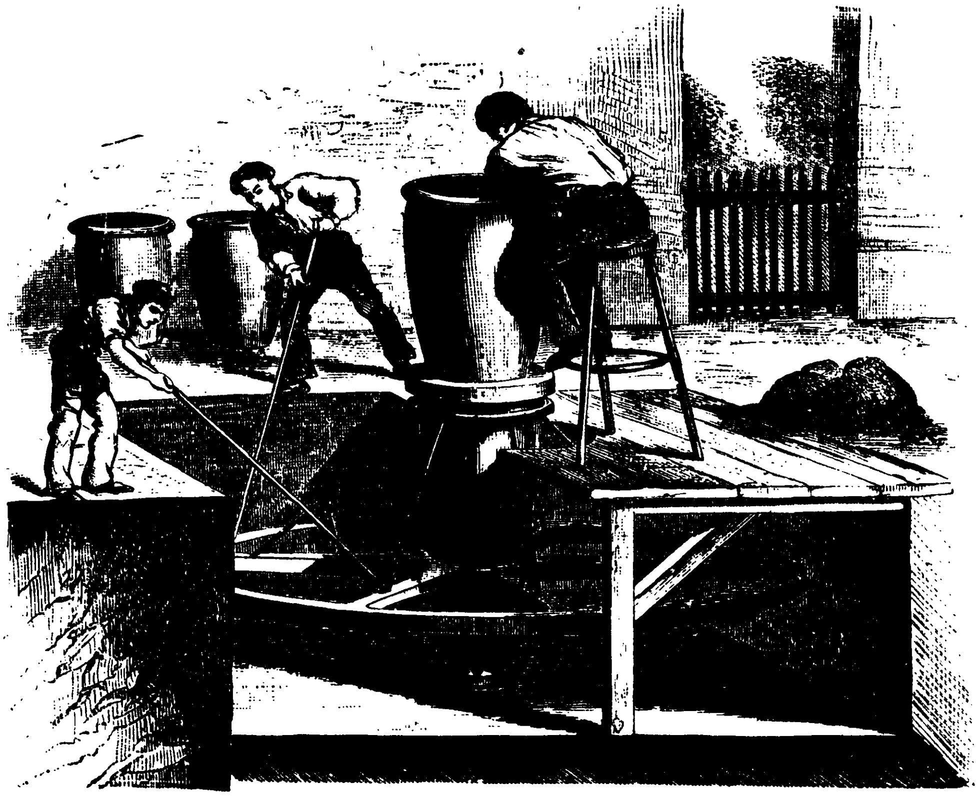
THE "AUTOMATIC" STEAM ENGINE.

A new patent steam engine called the "Automatic" has just been brought out by Messrs. Deakin, Parker & Co., of the Sandon Works, Salford, England. The new engine, which is shown in accompanying engraving, is claimed to be the cheapest and most economical engine in steam, oil and attention. We can well understand that this type of engine must have cost the patentees many years' labour and a large outlay to complete and bring it to perfection; and as the "Automatic" engine is designed specially to meet an acknowledged want, in that it supplies a thoroughly good engine at a low price, the firm may be congratulated on having compassed the object they had in view in introducing it. All parts of these engines are made to templet, and are interchangeable, thus securing the best possible workmanship with undeviating accuracy. The cylinders are all steam jacketed, carefully covered with non-conducting composition, and lagged with steel plates. The valve is circular and oscillating, and perfectly free to adjust itself to the cylinder face. The piston is provided with cast iron packing rings, kept steam-tight in every direction by a rolled spiral steel spring; the piston rod is of steel, secured by a nut into the piston, and by a steel cotter into the crosshead, which is also of steel. The sides of the crosshead form the slide blocks, and these are of unusually large dimensions, so that practically no wear can take place. Both top and bottom bars are provided so that the engine can be driven either under or over. The connecting rod is of steel, fitted with phosphor bronze steps, and is in all cases two and a half times the length of stroke. The crank shaft of the class "F" type is of the locomotive form, also of steel. The crank shafts of other types is wrought-iron, provided with a balanced cast-iron disc, turned and polished; and all pedestals are provided with phosphor bronze steps, which wear five times as long as brass or gun metal. All these engines have Deakin, Parker & Co.'s patent noiseless automatic variable expansion governing gear, which only requires keying to the place marked for it on the shaft; and no attention whatever is necessary beyond the application of a little oil occasionally. This patent automatic expansion governor is contained within a drum, made whole or in halves, which is made of a suitable diameter for driving from, and turned and crowned for the belt. It is sold separately, if necessary, for placing upon any existing throttle valve engine, thus converting it, at a small cost and a few hours' stoppage, into an automatic variable expansion engine. These engines, with the improved extra large condensers, are found to work with a fuel economy equal to most expensive and complex compound engines.

Taking Casts in Plaster of Paris.—You will never get good sharp casts if you use very thick plaster; you will find some soft grease such as lard better than oil, as it adheres better and does not tend to rise to the surface, and it is not so likely to be absorbed by the plaster. You can put the lard on with a stiff brush; in order to prevent the air bubbles, flood the surface of your mould with water, and let the plaster sink through the water, then pour the water off. Knock the mould on a table or bench, this will force the plaster into every crevice. The water will not hurt the plaster if you are quick with your work. Don't attempt to remove the cast until it is hard and dry; then if it will not come off easily soak it in boiling water, or heat the metal to which it is attached. Tapping the metal with a mallet might be of service. If you afterwards in using the plaster cast require much pressure, the plaster must be inclosed in a ring or box of iron, or even wood, as very few samples of plaster that I have seen (and I have had the best) will stand screwing up in a vice without some support.

Another writer remarks:—To avoid air-bubbles, put as much water as you require into a basin, and gradually pour in the plaster of Paris, taking care to stir all the time. Do this until it is of the consistency of oil paint, then pour into the mould. It is not necessary that the plaster be mixed with a minimum of water to make it harden, as if you give it a sufficient time, or if you put it by the fire it will harden perfectly well. It is not necessary that a superabundance of oil should be used, only a slight wipe over the surface of the metal with an oily cloth will prevent the plaster adhering to the metal.—Ecnal.

Coating Lead Pipes.—A method of coating lead pipes by incrustation with sulphide of lead is described as follows:—A hot concentrated solution of sulphide of sodium is allowed to flow through the pipes for ten to fifteen minutes. They then appear as if coated within with a gray glaze, and water afterwards passed hrough them remains, it is said, free from lead.



FAIENCE AND ITS MANUFACTURE, No. 1.

NOTES ON FAIENCE AND ITS MANUFACTURE.

The word "faience" is now generally used to designate that class of earthenware which, consisting of an interior body of white or colored clay, is externally covered with an opaque enamel, the base of which is formed of oxide of lead and tin. The art of enameling was introduced into Europe by the Arabs in the eighth century, subsequent to the invasion and subjugation of Spain. While enamel was at first used only to decorate pottery; it was gradually applied as an impermeable covering to replace the old primitive glazing. From Spain this art soon found its way into Italy, where goods enameled in this manner were called "majolica," from the island from which the first goods of this character had been imported. The largest majolica works in Italy were situated at Faenza, a small city near the river Po. A potter employed in that town, toward the end of the thirteenth century emigrated to France, and founded there the first majolica works, at Nevers. From the maker's native place these goods received in France the name "faience," which has since been universally adopted.

The faience industry soon became very important throughout France; this was especially due to various improved processes and apparatus invented by Bernard Palissy, of Saintes. The goods produced by him at the latter place were highly esteemed for their artistic merits, and are even to-day eagerly sought for by antiquarians. In Italy the ornaments were generally formed by hand, while Palissy used moulds of plaster of Paris and wood for that purpose. In this way he was enabled to furnish an unlimited number of copies of the same design at a lower price than his opponents, and he soon controlled the entire market. His eminent success induced King François I. to establish a faience factory at Rouen, and it was at that place that this branch of industry subsequently attained its highest development. Nicholas Poirel and one Poterat were the first private persons to which royal letters of permission were granted to engage in faiencery, in 1644 and 1673 respectively; in course of time that favor was conferred upon many others, and in the eighteenth century thousands of men and women were employed in the numerous workshops of that place. Rouen ware was very heavy but tasteful, blue being the predominating color, and employed in all shades. Few other colors were used.

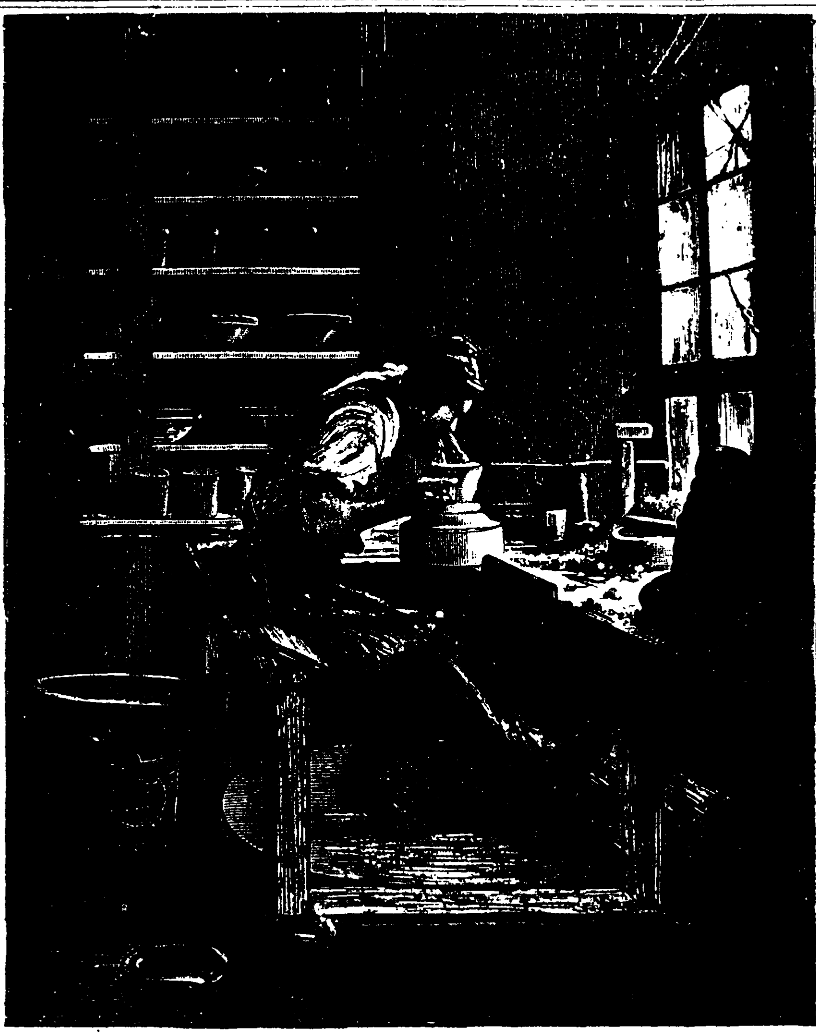
From France faience was gradually introduced into Germany and England. Nuremberg potters were especially renowned for their productions, and for nearly a century the faience of Hirschvogel and his sons, the principal manufacturers of that city, was exported to foreign countries all over the world. In England, Wedgwood, by his many improvements, his skill and energy, elevated the faience industry to the rank of one of the prime factors of English wealth.

In commerce there are distinguished two classes of faience principally, the "common" and the "fine." Common faience is again divided into the "brown" and the "white." For making brown faience the following mixture is generally used:

Clay	30 parts.
Green marl	36 "
White calcareous marl	12 "
Sand or quartz, containing a little clay	22 "
	100

White faience is composed as follows:

Clay	8 parts.
Green marl	36 "
White calcareous marl	28 "
Impure (aluminous) sand	28 "
	100



FAIENCE AND ITS MANUFACTURE, No. 2.

These materials are finely pulverized and then mixed in large rectangular tanks with sufficient water to form a thin, easily flowing liquid. The stony particles subside, and the supernatant mass is then drawn off through a sieve provided at one end of the tank, into large ditches dug in the ground in the neighborhood of the factory. These ditches are lined with cement, and in them the clay is exposed to the influence of the air. By this means its qualities are greatly improved. This is probably due to the action of the air on the iron and other metallic oxides present in clay. After three or four months the pulp is taken out and worked for some time on a table like dough. It is then formed in large balls, and again laid aside for several months in cellars or excavations to "ripen," by which it is said to be further improved in quality. Previous to use it is thoroughly kneaded with the feet and divided into portions of about 50 lbs. each, which are distributed among the formers for further manipulation.

Circular vessels are shaped on the wheel, moulds of wood, metal, and plaster of Paris being used for other shapes. Figs. 1 and 2 represent the wheels used in the operation. Fig. 1 shows a wheel used for pottery of larger dimensions; Fig. 2 one for making small ware. After being moulded the articles are dried either in the air or in special drying rooms, and then go to the "finisher," who, with an iron or steel tool, perfects the form and makes the necessary impressions. Next, the handles and various ornaments are attached and dried again in a hot air chamber, when the goods are ready for the oven.

A correspondent of the *Scientific American*, rendered highly sanguine by recent achievements of science in skin-grafting and the regeneration of nerves, proposes to remedy blindness by grafting healthy eyes on the blind—the required eyes to be taken from criminals condemned to death, who may well spare them!

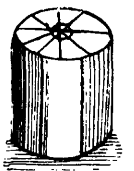
Coating Metals with Tin.—The process of coating metals with tin promises to extend its use for culinary and other purposes. Its electro deposition is proposed by means of a zinc and carbon battery. The inner cell containing the zinc is filled with dilute sulphuric acid. The articles to be coated with tin are put into a bath composed of eight parts of protochlorid of tin, 16 of cream of tartar, and two of the chlorid, if the latter is used. When it is present the tin coating is effected more rapidly, whereas, when the bath is composed of protochlorid of tin and cream of tartar only, the tin coating is very white, but is not produced so rapidly as when the chlorid is used. These ingredients should be dissolved in about 100 gallons of distilled water. The black plates are first "pickled" in any suitable manner, and then immersed in the above-described bath or solution, and are allowed to remain in the same for a longer or shorter time, according to the thickness of the deposit or coating of tin required on the plates. While in this bath the plates or other pieces to be coated are connected by a wire with the positive end of the battery, while the negative end of the battery is connected with a piece of tin hung in the same bath. When the plates or other pieces or articles have been sufficiently coated with tin, they are held over a fire in order to give the tin a lustrous appearance.

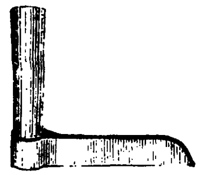
Stout calico is made water-proof by the Chinese with a preparation which proves efficient in any climate, and is supposed to be composed of the following ingredients: Boiled oil, one quart; soft-soap, one ounce, and beeswax, one ounce, the whole to be boiled until reduced to three-quarters of its quantity when mixed. The calico treated with this mixture answers well for life-saving apparatus.

Starch soaked for a year in a cold saturated solution of common salt is gradually converted into glucose.

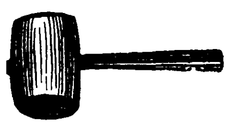
MAKING SPLIT AND SHAVED SHINGLES.

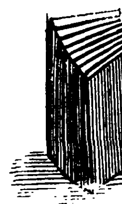
It is difficult to point out a roofing material better, on the whole, than well made shingles. If well made, well laid, and properly prepared for use, they may last a lifetime, which is as much as can reasonably be expected of any roofing. Shingles may be made of any timber that splits well and will not curl up after repeated wetting and drying. Pine, cypress, and cedar, are the best materials for shingles ; chestnut, oak, ash, hemlock, and other woods, may be used when the former can not be procured. The first step in making shingles is, to saw the timber into blocks of the proper length—14, 16, 18, or 24 inches, as the case may be.



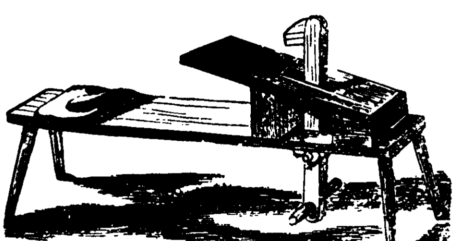


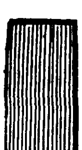
The block is then split into segments, as shown in fig. 1, by means of a tool known as a frow (fig. 2), and a mallet (fig. 3). The blocks are freed from the sap wood and the heart, and are then split down the sides in the manner marked at fig. 4, into shakes (fig. 5). The shakes are then held in a shaving-horse (fig. 6), and by means of a drawing-knife (figure 7), shaved down

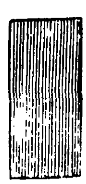




to a sharp edge at one end, and smoothed at the sides, when they are finished shingles (fig. 8). It is important to have the original blocks sawed true and square at each end, else the shingles will be imperfect, and the butts, which are exposed on the roof, lie irregularly. When finished, the shingles are put up in bunches of 250, or 400, each--that is, of so many nominal, not actual, shingles ; a shingle being held to be only 4 inches wide. So that one 8 inches wide counts as two, and one 6 inches wide counts as one and a half. Thus, a bunch of 25 courses (on each side)







with a 20-inch band, will have 1,000 running inches of shingle, equal to 250 shingles; or a 32-inch band with 25 courses will contain 400 shingles. The manner of packing shingles is too well know to require further description. There are several kinds of shingle-machines which saw them out of the blocks, and by using these, the shingles may be made of timber which will not split, even cross-grained timber, or that with knots, if these are tight, may be used. A sawed shingle roof lies closer than one of split shingles, but as there is a fuzzy surface left by the saw, they soak more water, dry more slowly, and are less durable than the other.—*American Agriculturist.*

Miscellaneous Items.

DISTINGUISHING IRON AND STEEL TOOLS.—We find it stated in a contemporary that it is a difficult matter—that they have the same polish, the same workmanship, and that use alone can show the difference. It is recommended that in order to make the distinction quickly to place the tool upon a stone, and drop on it some dilute nitric acid, (four parts of water to one of acid). If the tool remains clean, it is of iron ; while if of steel it will show a black spot where touched by the acid. These spots can easily be rubbed off. We must here remark that we never had much difficulty in making the detection ; the polish of steel is most always more perfect than the polish of iron, because the harder a metal is the finer the polish it can be given, while the hardness is easily tested by a file, which we far prefer to a drop of acid. Usually, when we have no file at hand, we take our steel pocket-knife, and if the tool is good steel the point of the knife will not make any impression ; if the tool is iron, or of a grade of steel softer than the steel the knife is made of, it will make a scratch ; if the knife does not make a scratch, a file often will, as files are, as a rule, harder than cutting tools.

TO PREVENT CORROSION.—Boil a large excess of so-called zinc dust for some time with a concentrated solution of caustic soda or potash, and place therein the articles to be coated. After a few minutes a mirror-like film of zinc will form upon them by the decompositiom of the alkaline solution, in consequence of their electro-negative character in combination with the zinc. It is suggested that the process may also be used for forming a layer of tombac by heating a copper article thus coated carefully up to 248° to 284° Fah., (best under olive oil), when the zinc will unite with the copper supposed to form a gold-tinted tombac, and the articles need only be quickly cooled in water, or some other suitable liquid, as soon as the desired color is apparent.

BLACKBOARD PAINT.—The following is a good recipe : One quart of shellac dissolved in alcohol, 3 ounces of pulverized pumice stone, 2 ounces of pulverized rottenstone, and 4 ounces of lampblack ; mix the last three ingredients together, moisten a portion at a time with a little of the shellac and alcohol, grind as thoroughly as possible with a knife or spatula, after which pour in the remainder of the alcohol, stirring often to prevent settling. One quart will furnish two coats for 80 square feet of blackboard not previously painted. The preparation dries immediately, and the board may be used within an hour if necessary.

MAKING INSCRIPTIONS ON STEEL TOOLS.—On the place you wish to make the inscription put melted wax or paraffin, and when cold cut with an instrument the letters or designs in the wax, cutting it through, so as to reach the metal. The neater you do this the neater the inscription will be, as every part of the metal exposed will become marked. Then make a little wax border around the name so as to prevent the liquid poured on from running off. This liquid may be nitric acid or aqua regia, which is a mixture of 1 part of nitric acid and 2 of hydrochloric acid. After a few minutes pour off the liquid and wash with water, then warm the tool to melt off the wax or paraffin.

MAKING HOLES IN HARD STEEL.—Nitric acid will do it. To apply it cover the steel plate, at the place where you wish the hole, with a thick layer of melted vax ; when cold, make a hole in the vax of the size you want the hole in the plate, then put on one or more drops of strong nitric acid, leave it on for some time, wash off with water, and if not eaten through, apply other drops of the same liquid, and continue this until the plate is perforated.

FIRST AMERICAN PATENTS.—The first patent was granted in 1790. If we are not mistaken, it was granted to Jacob Perkins for a nail forging machine—at least this invention was made in that same year. The number of inventions patented the first ten years was comparatively very small—no more than at present are granted every week, namely, 306 patents are recorded from 1790 to 1800.

GLUE.—Melt your glue in small quantities. Newly made glue holds much stronger than that which has been remelted. Apply the glue as hot as the nature of the work will admit, heating the pieces to be joined, if this can be done without injury. The sooner good glue is used after it is fitly prepared for use, the better will be the result.

Lubricants.—The evils attending the use of oils and fats as lubricants upon machinery are well known to engineers and mechanics, but the causes and nature of their injurious action are not so generally understood. We give, therefore, a brief but very lucid explanation of their action which we find credited to Dr. Marquardt, by our contemporary, the Boston *Journal of Chemistry*. The most obvious and least objectionable evil attending their use is the gradual oxidation (or gumming) which they undergo, and in consequence of which their lubricating qualities rapidly diminish. A more objectionable property of these substances shows itself when they are applied to such parts of machinery as are more or less highly heated. In such circumstances, these substances are decomposed into their constituents, glycerine and fatty acids. The latter combine with the iron work of machinery to form an iron soap, the metal surfaces being corroded thereby and fresh surfaces exposed to corrosion. Marquardt recommends the substitution of the mineral oils (heavy petroleum products that boil above 600° F.) for animal oils and fats as the remedy.

The American Rapid Telegraph Company is the title of a new organisation just formed to cheapen existing telegraphic rates. One of the novel inventions it is reported to control, but of which no published description has yet appeared, is a system of transmitting a fabulous number of words per minute. The following are among the reforms which the public are promised when the new organisation is once at work. (1.) Immediate dispatches (express messages) will be transmitted to all stations east of the Rocky Mountains at the uniform rate of 25 cents for 30 words. (2.) Mail messages will be dispatched within an hour, and delivered through the nearest post-office, or by messenger within two hours from time of reception, at 25 cents per 50 words. (3.) Press reports, for exclusive use of one-paper, at 10 cents per 100 words. (4.) Night messages to be delivered before 9 a.m., at 15 cents for 50 words. The company promise within three years to telegraph ordinary business letters to and from all points of the country for 10 cents.

Proposed Cultivation of the Egyptian Lentil.—Professor Anton Tomaschek, of Brunn, writes to impress upon agriculturists the great value as a food-stuff of the Egyptian lentil. From minute microscopical examination he has arrived at the conclusion, which we published years ago, that the meal of this seed forms the basis of the patent nutritive food so largely sold at altogether fancy prices under the name of "Revalesciero." The results of his experiments in growing this plant, continued ever since 1874, show that it thrives well in Moravia in soil of very moderate quality, and there is little doubt that it would succeed still better in the central and southern governments of Russia, where the conditions of the soil are even more suitable for its cultivation. The seeds of this kind of lentil are smaller and less flat than the ordinary varieties, and are especially distinguishable from them by the reddish colour of their flesh, which appearance is maintained in the meal prepared from them.

The War Department is on the point of at length adopting war balloons into the land and sea services. Movable apparatus for inflating and manipulating military balloons in the field has just been completed in the Royal Arsenal, Woolwich, and been tried with two new balloons, specially constructed for military purposes. The appliances consist of a portable tank, weighing 400 lb., containing iron shavings, together with a portable boiler and furnace. The appliances can be moved about with troops on the field or on vessels at sea. Hydrogen is generated by passing steam through the iron turnings. As soon as the necessary arrangements can be made it is in contemplation to send a few war balloons out to Zululand, so says *Nature*, but the fragments of one of the balloons are still missing. They are, it appears, not quite manageable war coaches.

Electrophone.—C. Ader uses a sort of drum, having on one side a diaphragm of parchment paper, about 15 cm. (5·9 lin.) in diameter, in the centre of which are circularly arranged six bits of tinned iron 1 cm. (·374 in.) long, and 2 mm. (·597 in.) wide. Upon these act six microscopic horseshoe electro-magnets, which are connected and set in action by a carbon-speaking microphone. A Leclanché pile of three elements transmits words and music so that conversation can be heard 5 meters (16·4 ft.) from the instrument. The energetic efforts are due to the minuteness of the electro-magnets, which can be magnetised and demagnatised much more rapidly than in other systems.

A New Steam-Proof Cement.—*Dingler's Polytechnic Journal* gives a description of the manufacture of a new steam-proof cement, discovered by Mr. A. C. Fox, which, it is claimed, is not affected by hot or cold water, nor by acids or alkalis. First, a chromium preparation is made in the following manner: 2.5 parts, by weight, of chromic acid are dissolved in a mixture of 15 parts of water and 15 parts of ammonia. To this solution about 10 drops of sulphuric acid, and, finally, 30 parts of sulphate of ammonia and 4 parts of fine white paper, are added. When about to be used, gelatine dissolved in dilute acetic acid is added.

Requirements of a Good Boiler Water.—Mr. W. F. K. Stock, in a recent communication to the *Chemical News*, defines the requirements of a good boiler water in the following terms: It should be characterized by: 1. Freedom from any very appreciable quantity of suspended mineral matter. 2. Absence of any trace of mineral acids, or of acid salts, or corrosive salts of any kind. 3. Absence of oily or fatty substance of any kind. 4. And, finally, a good boiler water should not contain more than 30 grains of solid matter per gallon, and not more than the half of this quantity should precipitate on boiling under pressure.

Boots and Shoes with Stone Soles.—The *Engineer* states that a German inventor proposes to make boots with stone soles in the following manner: He mixes a suitable quantity of clean quartz sand with a water-proof glue, and spreads it on a thin leather sole, which is employed as a foundation. These quartz soles are said to be flexible and almost indestructible, while they enable the wearer to walk safely over slippery roads.

Cement for Cast Iron.—Five parts of sulphur, two parts of graphite, and two parts of fine iron filings are melted together, taking care that the sulphur does not catch fire. The parts, previously warmed, are covered with the cement, reduced to a pasty consistence on a fire, and firmly pressed together. This cement, it is said, is very well adapted to fill out leaks in cast iron vessels.

Furniture Polish.—The following I find very useful for family use:—1 oz. beeswax, ¼ oz. white wax, 1 oz. Castile soap. The whole to be shred very fine, and a pint of boiling water poured upon it; when cold, add ½ pint of turpentine and ½ pint of spirits of wine; mix well together. To be rubbed well into the furniture with one cloth and polished with another.—Wm. A. Britten.

A method of breaking in horses by means of a galvanic battery was the subject of a recent patent in this country, and exception was taken to it as being both ineffectual and cruel. The experiment has been tried by the General Omnibus Company of Paris, and the scientific experts appointed to report upon the method declared that it is less cruel than the ordinary practice.

Improvements in the Steam Engine.—Daney states that future improvement of the steam engine must be in the direction of remedying the following defects: The present small ranges of temperature, the waste of heat by radiation, the too ready heating and cooling of the cylinders and pistons, and mechanical inaccuracy.

Paper Bricks.—A manufactory of paper bricks has been started in Wisconsin. The bricks are said to be exceedingly durable and moisture-proof. They are also larger than the clay article. What next?

RECIPES FOR BLACK INK.

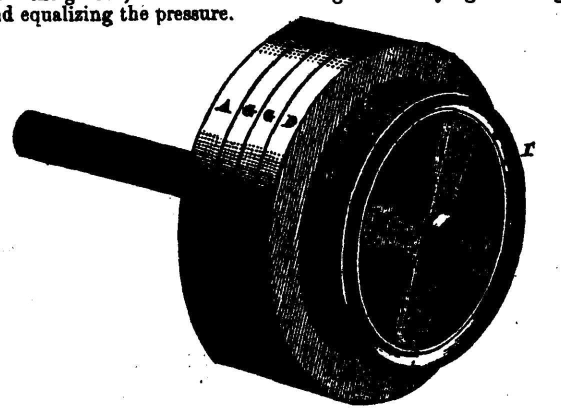
The following recipes from an exchange may be of use to some of our readers. The following is for jet-black steel-pen ink: "Bruised galls, 1 lb.; logwood, ½ lb.; cloves, ¼ oz.; pomegranate rind, ¼ lb.; water, 8 lbs. Boil gently for three hours, stirring now and then; strain off the decoction, and add 2 lbs. more water to the ingredients. Simmer gently for an hour, and strain. Mix the strained liquids, which together should weigh 8 lbs. Allow the dregs to subside, and pour off clear. Dissolve in a portion of it common gum, ¼ lb., sugar candy, 1 oz.; and in another portion sulphate of iron, ¼ lb. Strain both solutions, and mix the whole together. Then add calcined borax, 1 drm.; creosote, 12 drops; dissolved in ½ oz. of spirit of wine."

For blue-black ink the following is commended by good authority: Aleppo galls, bruised, 9 ozs.; bruised cloves, 2 drms.; cold water, 80 ozs.; sulphate of iron, 3 ozs.; sulphuric acid, 70 minims; indigo paste, 4 drms. Place the galls with the cloves in a gallon bottle, pour upon them the water, and digest, shaking often, for a fortnight. Press and filter again through paper into another gallon bottle. Next put in the sulphate of iron, dissolve it, add the acid, and shake briskly. Lastly, add the indigo, mix well, and filter again through paper. The ink is to be kept in well-corked bottles. The writing is at first pale green, but it soon turns to a deep jet black. It is not a copying ink, but may be rendered such by the addition of sugar or glycerine.

AN IMPROVED PISTON PACKING.

We illustrate herewith an improved piston packing, recently patented through the MINING AND SCIENTIFIC PRESS Patent Agency by Samuel A. Youse, of Sutter Creek, Amador county. The improvement is in that class of engine packings in which the packing is effected by the action of steam under pressure, which is allowed to enter the interior of the piston at each stroke and thus force the rings out to a bearing. It consists in a novel combination and arrangement of a series of three part external expansible rings, upon an interior externally flanged body, which is in turn supported upon or surrounds the spider. This body has circular grooves surrounding it centrally beneath each broad ring, and these grooves receive steam through passages from each end of the cylinder, so that the rings upon that side of the central flange only will be expanded by the action of the steam during the portion of the stroke upon that end of the cylinder. A peculiar spring is employed at the bottom of the piston when moving horizontally, whereby the piston head and follower are prevented from falling upon the side of the cylinder when running without steam, and thus wearing it out of true.

A is the piston head, *B* the spider, and *C* the body of the piston which is provided with a central flange, *D*. The rings are composed of three parts each; a broad ring which fits the body of the piston, and two outer rings, *G*, which are fitted upon the outside of this inner ring. Each of these rings is made in a simple piece with one cut, so as to make them elastic. The body, *C*, of the piston has grooves, *H*, turned upon each side of the central flange, *D*. These grooves lie beneath the center of the rings, *H*. Inner rings and holes, *I*, are drilled so that the grooves, *H*, will connect with similar grooves, *J*, which are formed on the edges of the part, *C*. When the follower is in position these grooves, *J*, will lie against the head, *A*, and follower respectively. Holes through the head and follower admit steam to the grooves, *J*, and from these, holes, *I*, admit it to the grooves, *H*, in the face of the body, *C*. The ends where the rings are cut are made to break joints so as not to leak steam, and as the inner ring has its center over the groove, *H*, the pressure will be central and there will be no side pressure by reason of the steam being admitted beneath one side or the other of the rings. Before admitted centrally it will be distributed equally outward from the groove, which is of advantage in steadying the rings and equalizing the pressure.



YOUSE'S IMPROVED PISTON PACKING.

The flange, *D*, fills the cylinder like the piston head and follower, and the rings are thus held in place, one set upon each side of this flange. In the drawing one set is shown in place and the other set removed to show the head. Steam being admitted to the cylinder it will enter the small holes upon that side of the piston, and passing through the channel, *J*, will enter the holes, *I*, and grooves, *H*, thus expanding the rings upon that side of the flange, while the rings upon the opposite side will remain loose. The reverse action takes place upon the return of the piston. The interior rings have each a pin projecting from them, and the double outer rings have corresponding grooves which fit the pin, preventing the rings from changing their positions.

In order to support the weight of the piston and prevent its dropping on the side of the cylinder, where it will wear the cylinder out of true when running without steam, as in locomotives, going down hill, a single adjustable spring is fitted within the spider, as shown, and it serves to keep the piston head and follower up by its elastic ends resting upon the body, *C*.

By this construction the inventor is enabled to simplify the steam packing. It economizes the steam employed by means of the grooves, producing a pressure outwardly from the center of the rings, which equalizes the pressure and the wear. An improved compound ring is provided, and the wear of the piston and cylinder is reduced to a minimum. The device is simple in construction and operation.—*Mining and Scientific Gazette.*

EASILY-MADE SLIDE REST.

While the most of the work to be done on the foot lathe may be accomplished as expeditiously and quite as well without a slide rest as with it, yet there are some operations that are greatly facilitated by means of this tool. Boring, for example, a very difficult thing to do with hand tools, may be done quickly and accurately by using a slide rest. In gear cutting—which will be described in a subsequent article—a slide rest is essential.

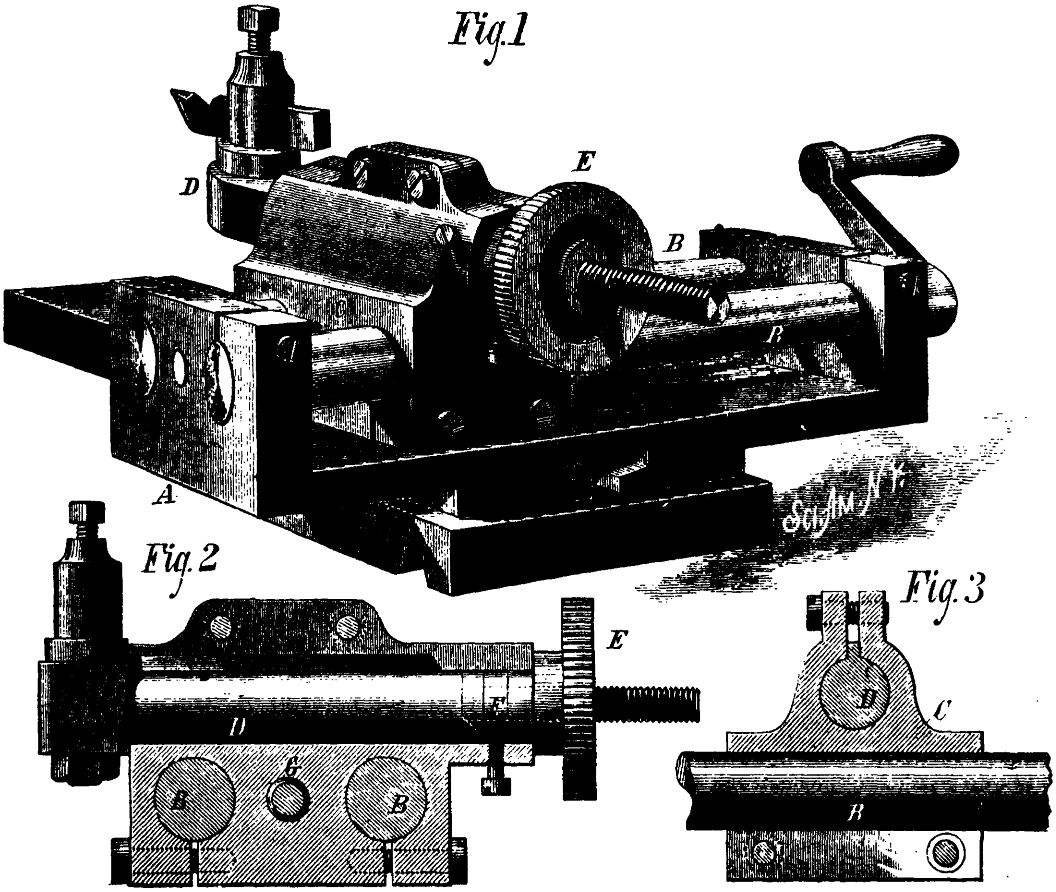
In the case of this tool, as well as others previously described, the purchase of a well-made article is recommended. Yet, if one has time and feels so inclined, he may make a really efficient slide rest with no other tools than his lathe and ordinary turning tools. Figs. 1 to 3 inclusive represent a slide rest that may be made in this way, Fig. 1 being a perspective view, and Figs. 2 and 3 respectively longitudinal and transverse sections of the tool carriage.

The T-shaped casting, A, has a longitudinal slot, which is made T-shaped in cross section to receive the head of the bolt that confines it in position upon the plate fitted to the lathe bed. The vertical ears at opposite ends of the casting are bored to receive the ends of the rods, B, upon which the tool carriage, C, slides.

The first operation in making the slide rest is to make one side of the casting, C, perfectly plane. It is then chucked in the lathe with the plane side next the face plate. Three holes are bored through it, two for the rods, B, and a smaller one for the screw, G. It is then chucked on an angle plate, so that the holes for the rods, B, are equally distant from the line of the lathe, and the hole for the rod, D, is bored very carefully to insure the parallelism of its sides. The casting, A, is now placed upon a plane surface, and the casting, C, is clamped to the ear at one of its ends, and adjusted so that a line drawn through the centre of the holes is exactly parallel with the bottom of the casting. The casting, C, is used in this manner as a template for drilling both of the ears for the reception of the rods, B. It will be necessary to exercise great care in drilling these holes, as it is of vital importance to have the rods, B, perfectly parallel.

The casing, C, may now be tapped to receive the screw, G, and the tool carrying bar, D, may be fitted to its place, and turned down and threaded to receive the internally threaded boss of the wheel, E. This boss is fitted to the base of the casting, C, and is grooved circumferentially to receive a split ring, F, the latter being drilled to receive the ends of three screws that project through the casting into it and prevent the boss of the wheel, E, from moving lengthwise of the hole, while the arrangement permits of the free rotation of the wheel. The bar, D, has a head which is drilled vertically to receive the tool post, and is provided with a heavy feather at the top, which is received by the slot formed by sawing into the upper portion of the casting, C. To render the bearing of the bar, D, somewhat adjustable, two screws pass through the casting above the feather. The tool post is of the usual description, having a loose collar above the head of the bar, D, and a nut below it. The mortise for receiving the tool extends a little below the loose collar, so that when the tool is clamped the post and ring will also be clamped. A slot is cut through the bottom of the casting, C, into each of the guide rod holes to permit of adjustment in case of wear by means of the screws which pass transversely through the slot. The ends of the rods, B, are fastened by a similar device. The screw, G, is prevented from end motion by a shoulder on the outside of the ear at the crank end, and a collar on the inside. The rods, B and D, may be made of steel or of cold rolled iron; the latter will be true enough without turning. The casting may be either of brass or iron; a good quality of iron will perhaps prove the most satisfactory. The slots may be cut with the saws described in a former article. The tools to be used with the slide rest have also been previously described.

In Fig. 4 is represented a boring device which will be readily understood without special description. The casting, A, is fitted to the tool rest socket and provided with a sliding bar, B, which is like the bar, D, in the slide rest above described, excepting that its back end is rounded and provided with a pin which slides in the slotted arm attached to the tail spindle of the lathe by which it is moved, instead of having a moving device of its own.



EASILY MADE SLIDE REST.

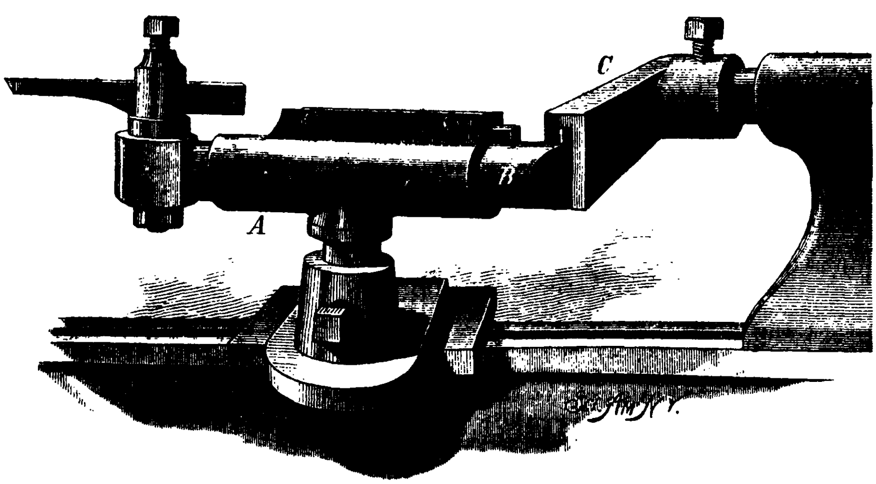
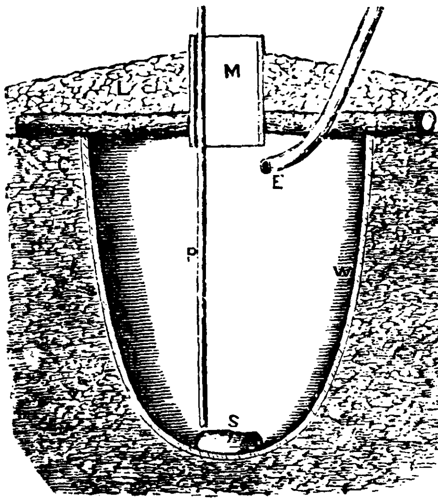


Fig. 4.—BORING ATTACHMENT.

Cheap Cisterns.—Plenty of good water is of prime importance everywhere. There can be no better water than that naturally distilled, falling as rain or snow. On the average, at least 300 barrels of it fall upon every building 20 feet square, annually—in some places more, in others less. To catch this from every roof and keep it for use as wanted, is not difficult if one has cisterns enough. *Cheap cisterns* are easily made whenever there is solid ground within 2, 3, 4, or even 5 feet of the surface. Remove the lighter surface (*L*), down to that which is compact (*C*). Dig as many egg-shaped cisterns as are required, 6 to 9 feet in diameter at the top, and 6 to 10 feet deep. Put upon the sides and bottom an inch thick, or so, coating of mortar made of clear sand and any good hydraulic cement, often called "water-lime." At the top of the *solid* earth, cover with any durable timber, heavy plank, or even poles or rails laid across with the ends extending 12 to 18 inches upon the solid



ground. Leave a man-hole (*M*) for entering, and for inserting pump-pipe (*P*), or for drawing water with buckets. The entrance of water is through the pipe (*E*). Spread cement over the wood covering. Fill in the earth (*L*), raising it above the level to shed off water. To apply the plaster (*W*), first coat the earth with a *thin* layer of equal parts of sand and cement, mixed soft and apply as soon as mixed, beginning at the bottom. Next apply an inch or more of mortar made of 1 part cement and 3 of sand. If the soil be not very firm, or if it is springy, let this coat be 1½ to 2 inches thick. Finish with a thin coat of equal parts of good sand and cement, and "white-wash" with a brush with a thickish mixture of cement and water with no sand. Put a flat stone (*S*) at the bottom for entering water to fall upon, to prevent wearing the cement. We have earth-wall cisterns like the above, covered with locust poles, that have done good service for over 20 years, with no signs of failure yet, and we know of many others like them.

A Vegetable Green for Confectioners.—It appears, according to one of our French exchanges, that from the grains of raw coffee there may be extracted a beautiful green coloring matter adapted to all the purposes of the cook and confectioner, and which will undoubtedly prove of great value as a commercial product, inasmuch as the number of green colors suitable for such uses, and which are not poisonous, is very limited. According to M. Zech, who describes the process of extraction, the coloring matter is obtained in the following way: The coffee grains are crushed and the oil is extracted by means of ether; they are then dried and agitated with the white of eggs, so as to form a sort of paste, and the latter is exposed for several days to the air. The presence of the white of eggs then determines the appearance of an emerald green. A simpler process is to merely moisten the crushed and desiccated coffee berries with water, expose them three or four days to the air, and extract the coloring matter by means of alcohol.

Protecting Lead Pipes.—The *Revue Industrielle* says that the interior of a lead pipe can be covered with an incrustation of sulphide of lead by making a warm concentrated solution of sulphide of potash flow through it for ten or fifteen minutes. Pipes thus treated seem to be covered with grayish varnish, which prevents the water flowing through them from acting upon the lead.

HOW TO GRIND EDGE TOOLS.

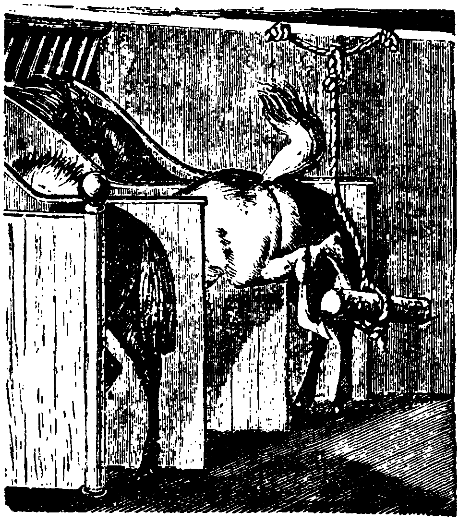
Edge tools are fitted up by grinding. The sharp grit of the grindstone, being harder than the iron or steel, cuts very small channels in the surface of the metal, and the revolving disk carries away all the minute particles that are detached by the grit. If we were to examine the surface of the tool that has just been removed from the grindstone under the lens of a powerful microscope, it would appear, as it were, like the rough surface of a field which has recently been scarified with some implements which formed alternate ridges and furrows. Hence, as these ridges and furrows run together from both sides at the cutting edge, the newly ground edge seems to be formed of a system of minute teeth, rather than to consist of a smooth edge. For this reason a tool is first ground on a coarse stone, so as to wear the surface of the steel away rapidly; then it is polished on a wheel of much finer grit; and finally, in order to reduce the serrature as much as possible, a whetstone of the finest grit must be employed. This gives a cutting edge having the smallest possible serration. A razor, for example, does not have a perfect cutting edge, as one may perceive by viewing it through a microscope. Beginners are sometimes instructed, when grinding edge tools, to have the stone revolve toward the cutting edge, and sometimes from it. When the first grinding is being done, it is a matter of indifference whether this is done or not; but when the finishing touches are applied near and at the very edge, a grinder can always complete his task with more accuracy if the periphery of the grindstone revolves toward the cutting edge, as the steel that is worn away will be removed more easily; whereas, when a stone runs in the opposite direction, the grinder can not always tell exactly when the side of the tool is fully ground up to the edge. This is more especially true when the steel has a rather low or soft temper. The stone, when running from the edge, will not sweep away every particle of the metal that hangs as a "feather;" but when the stone revolves toward the edge, there will be no "feather edge" to deceive the eye of the grinder.—*Cassell's Household Guide.*

What Science has Done for Productive Arts.—When gas was first made for illuminating purposes, some of the substances produced by the distillation of coal and the purifying of the gas, were considered unmitigated nuisances. But these disagreeable products did not escape the persevering investigations of the chemists, and the results are among the wonderful discoveries of science. A curious illustration of the economical value of the ammoniacal liquor is given in the report of the business of the gas works at Bradford, in England. For 10 years a contractor paid £800 a year for this substance, now a new contract has been made by which the company receives £10,359 per annum for it. Fifty one thousand seven hundred and ninety-five dollars is a very pretty sum to receive for an article formerly regarded as having little value. The brilliant colors produced from this liquid make its great value.—*Paint and Drug Reporter.*

To Restore the Lustre of Jewellery.—Take one ounce cyanide potassium and dissolve in three gills of water. Attach the articles to be cleansed to a wire hook, immerse and shake in the solution for a second or two, and remove and wash in clean water, then in warm water and soap. Rinse again, dip in spirits of wine, and dry in boxwood sawdust. If the solution is kept, put it in a tightly corked bottle, and label *poison* conspicuously. One caution is necessary: Do not bend over the solution so as to inhale the odor, nor dip the fingers in it; if one of the articles drops from the hook, better empty the solution in another vessel.

Compressing Liquid Metal.—We have already alluded, in these columns, to the importance of compressing metals while in a liquid state, to increase their strength when cold. A late number of *Van Nostrand's Magazine* contains a lengthy article on this important practical fact, in which the writer thinks the practice of casting under pressure is likely to be extensively adopted in the manufacture of steel. The process of cold-rolling has been found to increase the strength of bar iron in some cases as much as 100%.

Beautiful Black Color for Bronze.—A strong concentrated thin solution of nitrate of silver is required for this purpose. It should be mixed with an equal solution of nitrate of copper, and well shaken together. The pieces which require coloring are dipped into this solution and left for a short time. When taken out, they should be equally heated till the required black color makes its appearance.



DISCIPLINE FOR A KICKING HORSE.—The method (illustrated on above) of curing the habit of kicking in the stable, so frequent with nervous horses, is given, with the accompanying sketch, by a German subscriber. It is to hang in a proper position, behind the horse, a log of wood, by means of a rope fastened to the beam. When the horse kicks, the log is struck, and that swings back against him, with sufficient force to suggest that his kick is always returned. This lesson is soon learned by him and becomes effective. When not in use, the log is hung up out of the way by a hook upon the beam.—*American Agriculturist.*

Scientific.

THE VELOCITY OF SOUND.—A memoir is published by William W. Jacques, in the February number of the *American Journal of Science and Arts*, on the velocity of very loud sounds. The author gives an account of experiments, made at the United States Arsenal at Watertown, Mass., for the purpose of obtaining automatic measurements of the velocity of sound near a cannon. Behind the cannon—a six-pound brass field-piece—he placed at distances of 10, 30, 50, 90 and 100 feet from its mouth ingeniously constructed membranes, having an electrical connection with a chronograph capable of recording .00001 of a second. He found that the velocity of the sound was not greatest at the immediate rear of the cannon, but at some distance from it, where it rose to a maximum "considerably above the ordinary velocity, and then fell gradually to about the velocity usually received." When the cannon was turned at right angles to the line of the series of membranes the distance of the maximum velocity of the sound came nearer the cannon. From these facts the author concludes that the velocity of sound is a function of its intensity, and that the experiments upon the velocity of sound in which a cannon is used contain an error, probably due to the bodily motion of the air near the cannon. The employment of a musical note of low intensity is, therefore, recommended to correctly determine the velocity of sound.

IS CONDENSED STEAM EXPLOSIVE ?—The following appears in a Boston daily paper: To economize heat, it is common to pass the steam from the cylinder to the tender in a locomotive, to be used again and again. A similar process through the condenser is in vogue on board of steamers. For some time Mr. R. C. Blackall, Superintendent of the motive power of the Delaware and Hudson R. Co., has been experimenting with this condensed steam, and among other important discoveries, has found that it becomes highly explosive without giving any warning, under certain circumstances, which are liable to occur at any time. He thinks it probable that some of the missing ocean steamers have been blown up by condensed steam. Locomotives, he contends, are exposed to the same danger. Now if this is so, Mr. Blackall ought to make it known as extensively as possible for the safety of life and property.

NEWLY DISCOVERED FOSSIL BIRD TRACKS.—The lower Connecticut valley seems to be quite as full of giant fossil bird tracks, in stone, as the upper region about Turner Falls, where Professor Hitchcock made his discoveries. Messrs. Coe & Fowler have just uncovered, in their quarry on Powder Hill, half a mile west of the Middlefield and Durham station, a layer of stone indented several inches with bird tracks. Several on a line are three and one-half feet from each other, and measure fourteen inches on the centre claw, and outside claws being separated about a foot at the points. These tracks were made in the mud and ooze of a shore that was evidently washed by the tides, and each incoming tide deposited a layer of silt, or mud, which became sufficiently hardened in the sun to retain the form of the impression, and in that shape the mud was slowly turned to freestone.—*Hartford (Conn.) Times.*

CHEAP STEEL.—The London *Times* remarks that "the Bessemer process has ruined the manufactured iron trade." But it has done more than this; it has distributed among many countries the manufacture of cheap steel, and thus enabled them to supply more fully their own metallurgical wants and the metallurgical wants of other countries, in lieu of their own previous partial dependance upon Great Britain for both iron and steel products.

CASTING METAL.

Hollow or ring-shaped ingots of steel or other metal are ordinarily made by casting the metal in a mold, in the centre of which is placed a core of some suitable material, by the removal of which, after the ingot or casting has become solid, the required central hole is left. This plan of casting the metal round a core presents several inconveniences, one of the chief of which is that the casting, if it is thin, is often less sound or less solid than a block of metal would be of the same bulk, but cast without the central hole; moreover, special precautions must in most cases be taken to avoid the risk of the metal cracking or tearing as it contracts round the core in the act of cooling.

With a view to overcome these inconveniences, Messrs. Taylor & Wailes, of Panteg, propose, instead of making such ring-shaped ingots or castings in a mold in the centre of which a core is fixed, by the removal of which, after the metal has become solid, the required hole through the ingot or casting is left as above mentioned, they pour the metal into a mold, which is kept in rotation by preference round a vertical axis by mechanical means at such a high velocity that the liquid metal, as soon as it is poured into the mold, is driven by the centrifugal force caused by the rotation of the mold against the inner circumference of the latter, so that as it cools, the metal becomes solidified in the form of a ring-shaped or hollow ingot or casting, the outer surface of which has the form of the mold, and the inner surface is more or less conical (or if the mold be rotated at a high velocity, the casting will be nearly cylindrical,) forming, in fact, a ring-shaped section of the paraboloid of revolution which is the form taken by the free surface of a mass of heavy liquid in rapid rotation round a vertical axis. The axis of rotation, instead of being vertical, may, if found more convenient, be inclined or even horizontal, provided that the velocity of rotation of the mold be sufficient to throw the liquid metal (when poured into it) into the required annular form.

A PEN WORTH RECOMMENDING.

We have been favoured with samples of the celebrated Spencerian Double Elastic Steel Pens, and after trying them feel justified in highly commending them to our readers. They are made of the best steel, and by the most expert workmen in England, and have a national reputation for certain desirable qualities which no other pens seem to have attained in so great perfection, among which are uniform evenness of point, durability, flexibility, and quill action. It is thus quite natural that the Spencerian should be preferred and used by professional penmen, in business colleges, counting-rooms, government offices, and public schools, and largely throughout the country. Indeed, so popular have they become, that of the "Number One" alone, as many as eight millions are sold annually in the United States.

The Spencerian Pens may be had, as a rule, from any dealer; but, when not thus obtainable, the agents, Messrs. Alexander Buntin & Co., 345 St. Paul Street, Montreal, will send for trial samples of each of the twenty numbers on receipt of twenty cents.

Machine Construction & Drawing.

(From *Collin's Elementary Science Series.*)

(*Continued from page 221.*)

should present no difficulty after working out the previous examples; however, as the curves $l'm'$, $m'o'$, are the projections of the intersections of two curved surfaces, and therefore somewhat different to the preceding example, we have worked them out in figs. 140, 141, Plate XIX., for the small end of the crank; those for the large end are obtained in a similar manner. The angle formed by the connection between the *web* g and the *boss* e is filled-up by a quadrant-shaped surface mn, $m'n'$; the circular surface ml cuts this surface; the curve $m'l'$ is therefore the projection of the intersection of the two curved surfaces ml, mn; and similarly the curve $m'o'$ is the projection of the intersection of mo, mn, which connects the *web* g and the *feather* f with the boss. The web and the feather are also connected by a curved surface similar to mn, $m'n'$. The construction lines show how the curves $l'm'$, $m'o'$, are obtained; the method used is the same as that employed for the preceding figures, lm in fig. 140 corresponding to $a'b'$ in fig. 136; the only difference is that lm is a curved surface, whereas $a'b'$ is a plane surface.

80. The dimensions of the crank are as follow (see figs. 138, 139):—$a = 2'..6''$, $b = 12''$, $c = 5''$, $d = 7\frac{1}{2}''$, $e = 3\frac{1}{4}''$, $f = 4''$, $g = 6''$, $h = 12''$, $k = 9\frac{1}{2}''$, $pq = 1'..1''$, $rs = 1'..4\frac{1}{2}''$; where a stands for half the stroke, b the diameter of the crank-shaft, c the thickness of metal round the shaft, d the diameter of the crank-pin in the crank, e the thickness of metal round the pin, f the thickness of the feather, g the thickness of the web, pq and rs the width of the web at pq and rs respectively, h the depth at the shaft end, and k the depth at the pin end.

81. The Eccentric is employed to change rotary into reciprocating rectilinear motion, chiefly where the extent of the motion is small compared with that obtained from the crank; one special feature in the eccentric arrangement is, that it can be applied to shafts without necessarily being fixed at one end, or causing a break in the length of the shaft, as at v, w, fig. 134. In figs. 143 to 145, Plate XX., is shown an eccentric which consists of a circular plate A, termed the *sheave*, usually keyed to the shaft S. The centre of the sheave and that of the shaft are a certain distance BC apart, this is termed the *eccentricity*; twice the eccentricity BC (= BD) is termed the *throw*, and corresponds to the *stroke* of the crank. As the sheave is fixed to the shaft it turns with it; the motion is taken from the sheave by means of the *strap* E, which consists of a ring in halves fitting into a groove cut in the sheave, and connected by bolts F, F. The strap does not turn round with the sheave, but oscillates, having P for a centre; and at the same time it receives a motion in directions BD, DB; therefore the strap must not fit the sheave too tightly. At G are inserted pieces of metal or hard wood, by adjusting the thickness of which, compensation can be made for the wear between the surfaces of the sheave and the strap. Attached to the strap by means of bolts, or by a *cotter*, as in the figures, is a rod HK which transmits the motion to the piece to be operated upon, as the slide-valve of a steam-engine, as in the the example, where L is one end of the valve-rod.

82. The dimensions of the several parts of the figures shown in Plates XX. and XXI. are as follow:—The throw BD is $2\frac{1}{2}''$, the diameter of the shaft S is $3\frac{1}{2}''$, the key T is $\frac{3}{4}'' \times \frac{7}{16}''$, and it is let into the shaft $\frac{1}{8}''$. The sheave A is $7\frac{3}{4}''$ diameter outside, $7\frac{1}{4}''$ diameter at the bottom of the groove, and $2''$ wide; the width of the groove is $1\frac{1}{2}''$; the thickness of metal round the shaft is $\frac{13}{16}''$, at g it is $1''$ thick to allow for the key-way; the rim e is $\frac{1}{2}''$ thick, and the arm f is $\frac{3}{4}''$ wide. The strap E is $7\frac{1}{4}''$ diameter inside, and $8\frac{1}{4}''$ diameter outside; the width is $1\frac{1}{2}''$ *bare*;* each half is provided with *lugs* $\frac{5}{8}''$ thick, through which pass bolts F $\frac{3}{4}''$ diameter; the distance, centre to centre, of the bolts is $9\frac{1}{2}''$; at V on one half of the strap is a boss $1\frac{1}{2}''$ diameter to receive one end of the rod HK; U, U, are feathers $\frac{1}{2}''$ wide, whose object is to strengthen the connection between the boss and the strap; W is a collar on the boss V $1\frac{5}{8}''$ diameter and $\frac{3}{8}''$ wide; the distance from the outside of the collar to the centre B of the strap is $6''$. The cotter Q is $3''$ long, $\frac{3}{16}''$ thick, and $\frac{7}{8}''$ wide in the middle; the amount of *taper* in its length is $\frac{1}{2}''$ per foot; M is an oil-cup forming part of the strap, a section of which is given in fig. 146; R is a hole through which the oil passes; the cup is $1\frac{1}{2}''$ diameter outside, and $1\frac{1}{4}''$ diameter inside; the tube is $\frac{1}{2}''$ diameter, the hole $\frac{1}{4}''$ diameter; the distance from the top of the cup to the centre line is $4\frac{1}{8}''$; the cup is provided with a cover O, which is screwed into the cup; the diameter of the screwed part is $1''$, but the thread is finer than that given for $1''$ diameter in Table II., page 38. The edge of the cup-cover is generally *milled*, to allow of a better hold being taken when unscrewing it. The other dimensions may be taken from the figures. The eccentric-rod HK, is $2'..5\frac{1}{2}''$ from the centre P to the outside of the collar; the portion in the boss V is $1\frac{7}{8}''$ long and $\frac{7}{8}''$ diameter; the rod is $\frac{7}{8}''$ diameter at each end, and increases to $1\frac{1}{8}''$ in the middle; the end K of the rod is *forked*, and through it passes a pin X, connecting the valve-rod L to it; between the fork and the cylindrical portion K the cross-sections are rectangular and square; a portion of the latter has its edges chamfered, leaving the section an octagon, as shown in fig. 155. The dimensions of the forked end are marked on the drawings, figs. 153, 154. The pin X is prevented from leaving its position by means of a pin Y which passes through the former; between the pin and the fork is a washer $1''$ diameter and $\frac{1}{8}''$ thick; the pin Y may be either a piece of round *wire*, or of the form shown in fig. 156, which is termed a *split-pin*; the cross-section of the wire out of which it is made is a segment of a circle, nearly a semicircle; by opening out the halves of the pin at a, it is prevented from leaving the hole in which it is placed. The sheave is cast-iron, the strap is brass, and the rod, pin, washer, and cotter, are wrought-iron.

83. Fig. 142, Plate XX., represents in outline the eccentric arrangement; the centre line $a'y'$ is the path of the valve-rod, which passes through the centre C of the shaft; BEDF is the path of the centre of the eccentric; BD is the throw; the positions b, d, of the rod end correspond to the positions B, D, of the eccentric; $bd = BD$. The sheave is shown in four positions, I, II, III, IV, whose centres are B, E, D, F, respectively; the variable motion obtained from this arrangement is similar to that obtained from the crank as shown in fig. 133, Plate XVIII.

* To allow the surfaces of the strap and the sheave to slide past each other, one of them must be made a little less than the other; the term *bare* is used to denote this difference, which cannot be shown in the drawing.

84. The general problem is, given the throw of the eccentric and the diameter of the shaft upon which it is to be fixed, to make a drawing of the arrangement. In Plate XX., figs. 143 to 145, we have worked out the example, of which the dimensions are given in Art. 82, page 62. Fig. 143 is a front-elevation, fig. 144 is a plan, and fig. 145 is an end-elevation; they are drawn to a scale of $\frac{1}{4}$. Fig. 146 shows a portion of the sheave and the strap with the oil-cup in section; fig. 147 is a plan of the same; scale for both $\frac{1}{2}$. Figs. 148 to 156, Plate XXI., are portions of the figures shown in Plate XX. drawn to a scale of $\frac{1}{2}$.

85. The drawing of the figures in Plates XX. and XXI. is as follows:—Draw the centre lines *ay*, *a'y'*, *bz*, *cx*; let C be the centre of the shaft; from C as a centre with a radius CB (one half the throw), describe a circle BDN, which is the path of the centre of the sheave; through B draw the line *dw*, this will be the centre line of the sheave and the strap. From C and B as centres describe the circles for the shaft, &c.; and from the dimensions given, and from the construction lines shown, proceed to draw the figures. The only special points to be noticed are the intersections of the oil-cup with the strap, of the feathers U with the boss V and with the strap, and of the boss with the strap. These points we will now refer to.

The intersection of the oil-cup with the strap would be a case of the intersection of two cylinders whose axes are at right angles, but not in the same plane, as shown in figs. 143, 146, and 148, but the angle formed by the two cylindrical surfaces, as seen in those figures, is filled-up with a curved surface, and therefore there is no line of intersection to be seen in fig. 150. If the filling-up were omitted, the dotted line 0′ 1′ 2′ 3′, fig. 150, would represent a portion of the intersection of the two cylinders. On the right of fig. 150 is shown, by a dotted line 0 to 6, one-half of the *junction* of the curved surface, at the bottom of the oil-cup, with the strap; but there is no line produced, as it is not an *intersection*, because the two surfaces blend into one. However, we require the line to find the intersection of the curved surface with the face of the strap, as shown at 2*h*′4, fig. 148; the outer circle of the strap does not pass over the surface of the cup between 2 and 4, fig. 148, but terminates at these points, and then takes the curved form as shown. The boss V is joined to the strap by a surface similar to the one just described; the feathers U, U, are also connected to the boss and the strap by curved surfaces, and therefore, for the same reason as before, there is no line to be seen; the dotted line on the boss in fig. 148 represents the junction of the two surfaces.

86. We have shown in Plate XXII., figs. 157 to 160, the oil-cup and a portion of the strap drawn full size; the curved surface which connects the two is not of uniform cross-section between 0—6, 0—6′, figs. 157, 158, but changes from the form shown at 6′ VI′ to that at 00′. In fig. 158 the boundary lines of the curved connecting surface are 06′VI′0′0; the plans of 06′, 0′VI′, are the circles 06, 0VI, respectively. Fig. 160 is a projection of the curved surface 0′VI′0′, where it meets the cup, and of 06′0, where it meets the strap; the latter is cut by the faces of the strap *l′m′*, *n′o′*, in the points *b′*, *c′*; an elevation of this intersection is shown at *b′h′c′*, fig. 158; the curve is not quite correct, but it is a good approximation: to draw the curve correctly would require a better knowledge of curved surfaces than we can assume the student at present possesses. If the cross-section of the curved surface was uniform, *b′h′c′* would be obtained by a construction similar to that used to obtain *ab*, fig. 137, Plate XVIII.

87. The drawing of the eccentric-rod requires no special instructions, the forked end is shown in figs. 153 to 155. Fig. 153 is a plan, fig. 152 is an elevation, and fig. 155 is a cross-section, made by the plane SP, of the chamfered portion *pq* between the fork and the cylindrical part K. Fig. 156 is a section of the pin X showing the split-pin Y.

88. Cams.—The motion resulting from the two arrangements just considered is of a certain fixed kind; that is to say, all cranks and ordinary eccentrics produce the same kind of irregular rectilinear motion, which motion cannot be altered, except in the case of *shifting* eccentrics. By the use of cams we can obtain any kind of rectilinear motion we choose, either regular or irregular. They are generally made in the form of discs, or grooves: figs. 161 to 166, Plate XXIII., represent three common forms of cams. Fig. 161 shows one revolution of a *spiral*, which is used as a *base* for the cams shown in the remaining figures. Its construction is as follows:—Describe concentric circles of radii C0, C12 (3″ and 6″, respectively); divide the distance 0—12 into any convenient number of equal parts divisible by 4, say 12; and divide the circumference of the outer circle into the same number of equal parts; from these points draw radii; make one of them equal to C12, and each of the others in succession less than the preceding by $\frac{1}{12}$ of 0—12, the last one, C0, being in the same radius as C12.

Through the extremities I, II, III, &c., of these radii draw the curve; this is the required spiral. If now the spiral is centred upon C and made to rotate, having its curved surface in contact with a sliding piece at 0, which is free to move in a direction C12, then for equal arcs described by the spiral, the sliding piece will move through equal spaces; for example, if the spiral turns through an angle 2C12 ($\frac{2}{12}$ of a revolution) the sliding piece will move from 0 to 2 ($\frac{2}{12}$ of 0—12), and so on for each fraction of a revolution. The motion of the sliding piece is therefore uniform.

89. The form of cam described above can only be used for motion in one direction; but by using the one shown in fig. 162 we can obtain an alternate motion, which is also uniform. The cam in this example consists of two equal and similar halves, the distance between the two circles being divided into 6 equal parts instead of 12, while the circumference is divided into the same number as in fig. 161; this is usually called the *heart-shaped* cam. Fig. 163 is a cam for producing a regular motion, but the time occupied for the forward and backward motion is not the same, one being performed in $\frac{5}{12}$ and the other in $\frac{7}{12}$ of a revolution. Figs. 161 to 163 are drawn to a scale of $\frac{1}{16}$, figs. 164 to 166 to a scale of $\frac{1}{8}$.

90. The cams in figs. 161 to 163 are supposed to act upon *mathematical points*, which in practice is impossible, we have therefore to assign some size to the point acted upon by the cam; to illustrate this we will take a practical example and work it out. Let it be required to give to a roller A, 2″ diameter, attached to a sliding piece, and capable of moving in the direction SP, a regular alternate rectilinear motion of 6″, the distance from the centre of the cam to the centre of the roller, when at its greatest distance from C, to be 12″. Draw the centre lines *ay*, SP; from C as a centre with a radius of 12″, describe a circle cutting SP in A′; from A′ along SP towards C set off A′A = 6″, the extent of the motion; and from C as a centre with a radius CA′ describe a circle; divide its

(To be continued.)

Health and Home.

WORTH REMEMBERING.

1. Child two years old has an attack of croup at night. Doctor at a distance. What is to be done?

The child should be immediately undressed and put in a warm bath. Then give an emetic composed of one part of antimony wine to two of ipecac. The dose is a teaspoonful. If the antimony is not handy, give warm water, mustard and water, or any other simple emetic; dry the child and wrap it carefully in a warm blanket.

2. Some one's nose bleeds and cannot be stopped.

Take a plug of lint, moisten, dip in equal parts of powdered alum and gum arabic and insert in the nose. Bathe the forehead in cold water.

3. Child eats a piece of bread on which arsenic has been spread for killing rats.

Give plenty of warm water, new milk in large quantities, gruel and linseed tea; foment the bowels. Scrape iron rust of anything, mix with warm water and give in large draughts frequently. Never give large drafts of fluids until those given before have been vomited, because the stomach will not contract properly if filled, and the object is to get rid of the poison as quickly as possible.

4. A young lady sits in a draft and comes home with a bad sore throat.

Wrap flannel around the throat, keeping out of draft and sudden changes of atmosphere, and every half hour take a pinch of chloride of potash, place it on the tongue and allow it to dissolve in the mouth.

5. Child falls backward in a tub of water and is much scalded.

Carefully undress the child, lay it on a bed, on its breast if the back is scalded; be sure all drafts are excluded; then dust over the parts scalded with bi-carbonate of soda; lay muslin over it; then make a tent by placing two boxes with a board over them in the bed, to prevent the covering from pressing on the scald; cover up warmly.

Mower cuts driver's legs as he is thrown from seat. Put a tight bandage around the limb above the cut, slip a cork under it in the direction of a line drawn from the inner part of the knee to a little outside of the groin. Draw the edges of the cut together with sticking plaster.

6. Child has a bad earache. Dip a plug of cutton wool in olive oil, warm it and place it in the ear. Wrap up the head and keep it out of drafts.

A Word to Insurance Officers.—The *Plumber and Sanitary Engineer* suggests to life insurance companies, that instead of merely hammering at a man's chest to find if he has a tendency to any disease, would it not be well for the medical examiners of life insurance companies to inquire if he has not got a cesspool leaking into his well, or untrapped pipes beneath his basins and closets? More persons die of zymotic diseases in New York than from almost any other malady, yet a man living in the midst of contagious influences, and hence daily liable to take diphtheria or typhoid fever, would yet find little trouble in getting a heavy policy on his life. If insurance officers would give this subject their attention they might save many losses to their companies, and also benefit the public generally; for if men found that their homes were rated as "hazardous," they would soon begin to think of finding a remedy for the difficulty.

Alum in Bread.—Alum is sometimes used by bakers to make a good-looking loaf from an inferior quality of flour. The danger to health of using it freely has often been adverted to, and we notice that eminent English medical authority says that the general use of alum by bakers is one of the most fertile causes of dyspepsia, liver and bowell complaints in adults, and of debility and rickets in children. Bad teeth and their early decay is another consequence of the daily use of alum in food. It is claimed by physiologists that when there is alum in flour, the bone matter of the bread (phosphate of lime) instead of becoming assimilated by the system, is either wholly or in part converted into a salt of alumina, which is useless and incapable of appropriation.

Treatment for Distemper.—It will be interesting to lovers of the canine species to hear of a simple remedy for distemper. At the quarterly meeting of the Scottish Metropolitan Veterinary Medical Society, Mr. Baird mentioned the case of a colly dog in the last stage of the disease, and which its owner had determined to destroy. Shortly after being treated with doses of strong coffee and a little sweet milk, the animal, however, so far recovered as to be able to stand and walk. The chairman of the meeting said the case seemed almost unique.—*London Lancet.*

A Cure for Poison Oak.—Now that the picnic season attracts thousands of people into the country, we reprint the following cure for "oak poison," which several persons claim to have used with complete success: Dilute sweet spirits of niter with the same quantity of cold water; apply with a white cloth every ten minutes until cured. When of a few hours' contraction it seldom requires more than one application.

MILK AND LIME WATER IN NERVOUS DISORDERS.

In a paper on "Milk with Lime Water as Food and Medicine in Nervous Disorders," presented by E. N. Chapman to the Medical Society of the State of New York, at its recent annual meeting, the author deprecates the warfare of drugs against disease which is now being waged by specialists more vigorously and systematically than ever before. Digestion and assimilation, he asserts, are ignored, and the attention is absorbed by one or more prominent symptoms in a part remote from the primary source of morbid action. Consequently the efforts of the physician to cure his patient are too often unavailing.

He states that having used, the last few years, milk with lime water almost exclusively as the diet of his patients, he has attained a success unknown to him when he depended more on medicine and less on food. To illustrate the ready assimilation, the nutritive quality and the remedial power of milk, when rendered digestible by lime, he presented notes of a number of cases treated by him, embracing a class involving the nerve centres, and that are acknowledged to be little under the command of accepted modes of treatment; such, for instance, as marasmus, anæmia, paralysis, indigestion, neuralgia, chorea, dementia, and alcoholism.

In concluding his paper, Dr. Chapman remarks that the efficacy of milk with lime water in the illustrative cases brought forward by him is equally observable in others whenever, either primarily or secondarily, the nutritive functions are much at fault. The milk (with a pinch of salt) being rendered very acceptable to the stomach by the lime, may almost always with advantage be made the prime article of diet in the sick room, however diverse the conditions. It is the most digestible and at the same time the most nourishing food that can be given. It allays gastric and intestinal irritability, offers a duly prepared chyle to the absorbents, supplies the blood with all the elements of nutrition, institutes healthful tissue changes, stimulates the secreting and excreting glands, and, in a word, provides nature with the material required to sustain herself in her contest with disease. If it be conceded that nature always accomplishes the cure whenever it is secured, and that drugs merely aid, direct, or modify her efforts to this end, it will be self-evident that the food which supplies the vital forces with all the power of resistance they possess is a matter of the first importance, and that milk acted upon by lime, provided it contains all the essential properties of other articles epitomized, and is more friendly than any or all of them, has a range of application almost as extensive as the disease itself, whatever its character and whoever the patient.

CONSTIPATION.

It is doubtful if consumption numbers as many victims that are stricken down by the various diseases that result from habitual constipation. True consumption is an inherited disease. It may remain always dormant, but when aroused to action, decay commences at a point circumscribed, and gradually extends—unless arrested—until so much of the lungs become involved that vital action ceases. The evils of constipation result from inattention to the calls of nature, and usually commence with children whose habits are not closely looked to by their parents. The processes of nature are always active while life lasts. When effete matter is retained a moment beyond the time its expulsion is demanded, the system commences its efforts to get rid of it. When the natural egress is checked, the absorbents carry the more fluid portions of the poisonous mass into the circulation, and it becomes diffused throughout the body. The more solid or claylike portion is forced into the lower rectum where it becomes firmly impacted, thus cutting off the circulation in the small blood vessels, causing painful engorgement known as piles and hemorrhoids. A continuance of these troubles often results in fissure, fistula, or cancer. The trouble is seldom confined here. As a result of the blood poisoning we almost invariably find more or less dyspepsia, with decided derangement of the functions of the heart, liver and kidneys, accompanied by headache and nervous debility, often verging on paralysis.

HOW COFFEE IS ADULTERATED.

Professor S. P. Sharples, the State Assayer of Massachusetts, is making some analyses of articles of food, which are resulting in interesting disclosures. Packages of coffee have engaged his attention, but he has found very few traces of the berry itself. The following are some of the results of his examination :

"Hayward & Co.'s French Breakfast Coffee," the label of which sets forth that only three-quarters as much of it need be used as would be required if ordinary coffee was employed, is found to contain no coffee at all, but to be made of green peas, burnt molasses, and "an occasional grain of rye."

A package of "Pure Roasted and Ground Cape Coffee" was found to be made wholly of peas and nut shells, the latter floating when the mixture was put in water.

A package of "Kimball's First Quality Mocha and Java Coffee" contained no coffee at all, but consisted of peas and rye.

"Glinée's Extra Quality French Coffee" was almost destitute of any foreign substance, peas and rye predominating, with a few oats.

"Chase's English Breakfast Coffee" is a large consumer of peas, the traces of coffee being so slight that the assayer pronounced them accidental.

Happily the analyses have not disclosed the presence of any positively injurious substance, and if people, who can easily find out the cost of a pound of green coffee, expect to buy a like quantity roasted and ground for half the price, they deserve to drink weak pea soup. To detect adulterations, the following rules are given: Take some cold water in a glass and throw upon it about half a teaspoonful of the coffee to be tested, stirring it around so as to wet the grains. Pure coffee will float and scarcely color the water. Beans and chiccory sink to the bottom ; chiccory colors the water at once, beans more slowly. Test the part that floats by chewing it ; coffee will thus be recognized by its taste ; nut shells, which also float, are hard and brittle. A species of nut which has lately come into use, strongly resembles coffee when ground up, by floating on the water as well as by its feeling between the teeth ; but the difference can easily be detected, because the adulterating ingredient is nearly tasteless. After subjecting the suspected article to the above test, spread some of it on a sheet of paper and examine if carefully for grains of rye, oats and peas. The pea ingredient will frequently be found in pieces one-eight its original size, and the rye in half grains ; chiccory is tough when taken between the teeth, and has a bitter taste, different from the bitter coffee.

As to the roasted peas and rye which are sold instead of coffee, it is pretty certain that they are more wholesome than the fruit of the coffee plant, being destitute of any narcotic quality ; but the thing is a fraud, and it would be better for families—cheaper at least—to roast their own peas and make their own weak pea soup. As to chiccory, it is well known that at the restaurants in Paris and other French cities, all the coffee served to customers is largely adulterated with the roasted root of the plant, which is cultivated for that purpose, and much more wholesome than coffee.

Humour in the Family.—Good humour is rightly reckoned a most valuable aid to happy home-life. An equally good and useful faculty is a sense of humour, or the capacity to have a little fun along with the humdrum cares and work of life. We all know how it brightens up things generally to have a lively, witty companion, who sees the ridiculous point of things, and who can turn an annoyance into an occasion for laughter. It is a great deal better to laugh over some domestic mishaps than to cry or scold over them. Many homes and lives are dull because they are allowed to become too deeply impressed with a sense of the cares and responsibilities of life to recognise its bright, and especially its mirthful side. Into such a household, good but dull, the advent of a witty, humourous friend is like sunshine on a cloudy day. While it is always oppressive to hear persons constantly striving to say witty or funny things, it is comfortable to see what a brightener a little fun is—to make an effort to have some at home. It is well to turn off an impatient question sometimes, and to regard it from a humourous point of view instead of becoming irritated about it. "Wife, what is the reason I can never find a clean shirt?" exclaimed a good but rather impatient husband, after rumaging all through the wrong drawers. His wife looked at him steadily for a moment, half inclined to be provoked, then with a comical look, she said: "I never could guess conundrums ; I give it up." Then he laughed, and they both laughed, and she went and got his shirt, and he felt ashamed of himself and kissed her, and then she felt happy ; so, what might have been an occasion for hard words and unkind feelings, became just the contrary, all through the little vein of humour that cropped out to the surface. Some children have a peculiar faculty for giving a humourous turn to things when they are reproved. It does just as well oftentimes to laugh things off as to scold them off. Laughter is better than tears. Let us have a little more at home.

Moles Suckled by a Rat.—This is just the time of year when moles have young ; but infant moles are very difficult to get. We understand, however, that Mr. Frank Buckland has received, through Mr. Overton, head keeper of Windsor Park, five young baby moles. These little creatures present a very curious appearance ; each is the size of a large mouse, and they have no hair whatever upon them. They each weigh a little over half-an-ounce. When disturbed they lift themselves up and wave their heads round and round about in the air. Their noses are of a lovely pink, and the eye is just discernible through the skin like a black speck. There is no trace whatever of hair upon them, and they refused to take milk. A tame white rat, therefore, was procured, her young rats were taken away, and the moles substituted. After a preliminary examination the rat took kindly to the moles, made a warm nest in the corner of the box for them, and then coiled herself over them to keep them warm. The young moles have taken kindly to their foster-mother, and it is hoped that these royal moles may be ultimately reared through the attention of their wet nurse.—*Daily News.*

Poultices.—The common practice in making poultices of mixing the linseed-meal with hot water, and applying them directly to the skin, is quite wrong ; because, if we do not wish to burn the patient, we must wait until a great portion of the heat has been lost. The proper method is to take a flannel bag (the size of the poultice required) ; to fill this with the linseed poultice as hot as it can possibly be made, and to put between this and the skin a second piece of flannel, so that there shall be at least two thicknesses of flannel between the skin and the poultice itself. Above the poultice should be placed more flannel, or a piece of cotton wool, to prevent it from getting cold. By this method we are able to apply the linseed-meal boiling hot, without burning the patient, and the heat, gradually diffusing through the flannel, affords a grateful sense of relief which cannot be obtained by any other means. There are few ways in which such marked relief is given to abdominal pain as by the application of a poultice in this manner.

First Cousin Marriages.—These marriages are rarely prolific. Where children are born to those who are nearly allied in blood a very large percentage are either idiotic, deaf, blind, or weak. Many are scrofulous, puny, and stunted, and not a few cripples. Of seventeen cases examined by the Lunacy Commissioners of persons who had married near relations, Dr. F. Winslow says: "Out of ninety-five children, forty-four were idiotic, twelve were scrofulous, one was deaf, and one was a dwarf." If querist should wish to know anything further about it, I should be very happy to tell him what I know.—M. D.

Gold in Russia.—The St. Petersburg papers report a great development of the gold production in Russia. Strata containing gold dust in considerable quantity have recently been discovered in the Ural mountains. It is said that in the district of Sennigsel a Russian proprietor has found in his gold mine, near Motygym, a nugget 445 pounds in weight, representing a value of nearly $75,000.

To Remove Glass Stoppers.—Hold the neck of the bottle in the steam from the spout of a tea-kettle, and keep turning it round and round so as to heat the neck equally. In a minute or two (sometimes less) the stopper can be removed with ease. When the neck of the bottle is thick, the heat must be applied more gradually than when the bottle is a thin one.

Corks are made both air-tight and water-tight if plunged in melted paraffine, and kept there for about five minutes. Thus prepared, they can be easily cut and bored, and may be inserted in, or withdrawn from, bottles without any difficulty.

To Clean Silk.—A teaspoonful of powdered borax dissolved in one quart of tepid water is good for cleaning old black dress of silk, cashmere or alpaca.

CUTTING THREADS ON PIPES.

An improved apparatus for cutting screw threads on pipes has been patented in England by Mr. F. Armstrong, of Bridgeport, Connecticut, who claims several advantages for his invention. The apparatus is applicable in the ordinary way as a screw stock, but is specially adapted for use in a pipe-threading machine. The invention comprises the use of two separate or independent dies fitted in a recess or recesses in a metal plate by being bored or halved thereto, and bolted fast so that they can be readily taken out by removing the bolts or their nuts. Provision is thereby made for more readily removing the said dies for changing and sharpening them than is practicable with ordinary divided dies. The improved dies have slotted holes for the passage of the bolts by which they are fastened to the plate or holder, to allow them to be adjusted to suit the size of the pipe or tube to be cut. In the drawings Fig. 1 is a front view, showing the die-plate fitted in a holder, designed to be attached to an ordinary screw-cutting machine; Fig. 2 is a top or edge view of

FIG. 1

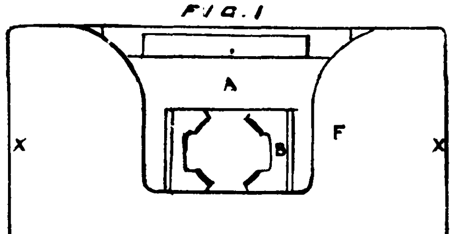


FIG. 2

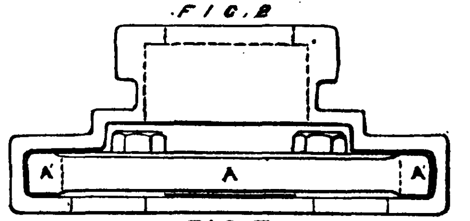
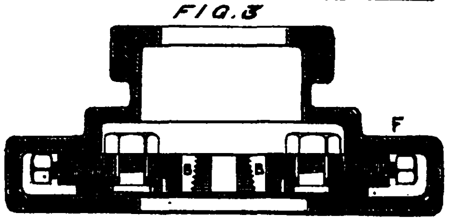


FIG. 3



same; and Fig. 3 is a longitudinal section on the line X, X. Fig. A is the die plate, recessed as shown to receive the dies B, which are also recessed or halved to fit in the recessed part of the plate flush with the surface, and they are secured by bolts C1, the holes for the bolts being slotted to allow them to be adjusted centrally with the guide D, which, when the said apparatus is to be operated by hand, is formed or fixed on the plate A. This guide projects from the plate A at right angles to its surface, and is fitted with bushes, through which the end of the pipe or tube passes to the dies B. The said bushes are secured in the guide by a set screw D1, and are removable so that they may be changed to suit pipes of various sizes. E E are the adjusting screws for setting up the dies; they pass through the ends of the plate A, as shown. These adjusting screws provide means for accurately adjusting the dies to the dimension of the tube when the latter is placed between them. The dies are bevelled on the outer corners, so that they may be sharpened by grinding off the said corners. These dies may be very simply and cheaply made by stamping them in the form required for connecting them to the plate. The solid die plate is recessed slightly deeper in the middle portion than in the other part to make room for the thicker portion of the dies. The lugs or projections A1 serve for the reception of the handles when the said apparatus is used for screwing pipes by hand. The improved die-plate holder or box, F, is preferably formed of cast iron; it has its rear portion shaped to enter the recess formed for its reception in the head of the machine. By its peculiar formation this holder affords a central opening, as shown in Fig. 3, for the passage of the pipes to the dies, B. A front recess is formed for the reception of the die plate, A, whose ends, A1, project and form lugs which, when the die plate is in position, lie adjacent to and in the same plane with the ends of the said box or receptable. These lugs, A1, it will be seen, extend to a distance not less than the length of the die-adjusting screws, and the turning of the die-plate is prevented by the contact of the said lugs with the box or holder, while at the same time the lugs protect the adjusting screws and prevent any accidental movement of the same. By the peculiar formation of the box or receptacle, F, dies, and die-plates longer than the head of the standard machines may be used, and as the die-plate box or holder extends forward a very short piece of pipe may be operated upon by the dies. And as the thickness of the front of the box in a working machine is only about one-quarter of an inch, the pipe-holder may approach to within that distance of the first thread of the cutting dies.

By reference to Fig. 3 it will be seen that the thread of the dies used in the improved die-plate is of a uniform depth and pitch throughout its whole extent, but is cut taper with two different angles of inclination, that is to say, the initial or front portion of the die has a greater inclination than the remaining portion, the advantage of this construction being that the enlarged diameter of the thread at the entrance of the die permits the free entrance of the end of the pipe, although it may be burred by the machine which cuts it into section, and the thread at this part of the die having the proper acute or angular form instead of being flattened on the top, will at once "bite" or grasp the pipe, and while reducing or cutting away the excess of metal will also "lead" or start the succeeding or following thread or cutter, which is less tapered, and which cuts it to the required guage. In ordinary dies the double taper is obtained by a reduction of the height of the thread, which produces a flat surface on the top of the thread, that shaves off the excess of metal from the pipe, but does not take hold of or enter the same to lead it to the succeeding or following threads. Moreover, by the above-described peculiar form of cutting thread the patentee says he is enabled to remove the excess of metal at the end of the pipe with much less power than is ordinarily required, and when it is desirable to remove the pipe from the dies it is much sooner relieved from strain or pressure. Mr. Armstrong also claims the following advantages:—The dies can be adjusted to variations in the size of the pipes or tubes, and can be worked with much less labour and accomplish the desired results in less time than the ordinary solid dies. The dies being made in two parts instead of one (as in the solid die), can be more perfectly constructed, their cutting edges can be reached more directly, and the work may be performed with greater precision and uniformity. The dies can be sharpened without drawing their temper, and can be kept in good condition more easily and with less expense than other dies. An ordinary mechanic can sharpen these improved dies, and is not obliged to send them to the manufacturer, as is the case with solid dies when they become blunt. Moreover, these dies are interchangeable in the stock, and although adjustable do not need adjusting to cut the standard size for which the dies are made. There are corresponding marks on the plate or stock and on the dies, and when these marks are brought into line the dies will cut the standard size.

CENTERING GAUGE.

A correspondent of the *English Mechanic* says:

The instrument here described, though not laying claim to novelty or originality, has not been seen by me elsewhere than in my own workshop, and may possibly be of use to some amateur mechanics. I have found it very useful for quickly and accurately centering metal rods from one inch diameter downwards. It is similar to an ordinary carpenter's gauge, having a sharp point instead of the usual somewhat flattened one used for wood work. A V groove is cut in the sliding piece as shown. By turning round the bar to be centred in this groove the point may be made to describe a very small circle concentric with the axis of the bar, and the centre can then be easily marked with an ordinary centre punch.