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NOTES ON THE NEW CANADIAN TARIFF.

NOW that the new Tariff Act has received the sanction of Her Majesty, we begin to feel that a third point has been gained in Canadian legislation of greater importance to her people than either Free Trade or Protection, and that it is now the acknowledged right of Canadians to impose such duties as they may think fit to protect their own industries, even though it be to the disadvantage of British mercantile interests. No politician, of whatever side of politics he may belong, can honestly believe in his heart that any duty which we may impose on English foreign imports is in any way intended to injure British trade. A few insignificant manufactures in Great Britain may feel a slight effect from our competition, but the day is far distant when Canada will be in a position, both in population and wealth, to become a rival to the Mother Country in those important manufactures which form the mainspring of England's wealth and greatness. When that day does arrive, Britain will find that she will have more to receive in return than she has to give. The encouragement that a fresh impetus, about being given to immigration, and the colonization of the country, which is about to be systematized, will, in a few years, bring about a greater return to English manufacturers than they will lose by our present law.

Until the tariff resolutions become law, each political party had a decided right to vote according to his own and the views of the majority of his constituents, but having done his duty, it would be injudicious in the extreme to endeavour to throw obstacles in the way of the country giving the new tariff a fair trial. If, after a sufficient trial—and it cannot fully be tested for the next three years to come—it turns out satisfactorily, it will be as much to the advantage of the manufacturers who opposed the protective duties, as it will be to those who were in favor of them; but until it shall have been plainly shown that a moderate protection to our industries is bringing ruin to the country, the subject should be allowed to rest.

The main object of the present protective duty on imports is to save our country, to some extent, from being made the slaughter market for American manufactures at periods of depression in American trade, or to meet some financial crisis in a large manufactory, which could sell its surplus stock in Canada at a low figure to realize ready cash, without injuring its own market. So great a difference is there between the population of the United States compared with the actual buying population of the Dominion, that one large factory alone could, out of its surplus stock, send into this country sufficient to effectually stop the demand for such goods as it manufactured for months afterwards, and thus not only throw out of employment our mechanics, but completely paralize our manufactures.

The object of the majority of the people in demanding protection, was not for the purpose of creating monopolies in trade or manufactures, or for the benefit of particular firms at the cost of the country, for such could not possibly happen with our enterprising neighbours so close at hand, and our own competition, to keep down prices: the intention was simply this, that when we can manufacture as cheap, and produce as good articles as made in the States, we deserve to have the privilege of making what we require in our own country, to employ our own mechanics, use our own raw materials, keep our money in Canada and spend it among ourselves for our own benefit and pleasure. Let us now, therefore, set earnestly to work and endeavour to bring about good results from the present change in our tariff by giving it a fair trial.

There is one important feature in which the success of our manufacturers depends, and that is upon the machinery they use, and the skill of the workmen they employ. In our machinery, it must be confessed, we are behind the Americans, and it cannot be expected that we can compete successfully with them, even with the tariff in our favour, until we put ourselves upon an equality in that respect. We have had an opportunity of visiting the principal manufactories in New England States, and can aver as to the disadvantages under which we lie in comparison. Not long since we visited a first-class factory in which was a machine which cost the proprietor about three times to manufacture a certain article what it does for work done by a superior machine used in the States. It is herein that lies the great advantage that Americans possess over Canadians—that is in superior machinery, skilled workmen, and a systematic method of conducting their business. Birmingham and Sheffield have awakened up at last to this fact, and now, instead of being outdone by their American cousins, are, by their improved machinery (thanks to the lesson taught them, which they were tardy to learn), outdoing them in quality and underselling their instructors. It is to be hoped, therefore, that the present protection given to our manufactures will not lull them into security, but lead them on to look more closely into these matters on which so much of their prosperity depends.

Whether Free Trade or Protection will ultimately be best for Canada, experience will soon tell. The present state of depression has been universal over the world, and ours cannot be set down entirely to what we have lost from the want of protection. A good deal of it in fact has to be attributed to there having been so many unscrupulous men in business—to extravagance, and a general lack of prudence and saving. We can trace the origin of our present poverty to many sources, and although we may deplore the present depression in trade, there is another source from which poverty has had its origin, and this has been from the increase of the growing social evil. Statistics have shown that the amount spent annually upon drink in Great Britain is nearly as great as the total of her export trade! Is not this something frightful? And yet when we see our own taverns so frequented by mechanics (we speak of mechanics only, having their interests particularly at heart) evening after evening, and knowing how much of their hard-earned money is spent in intoxicating drinks, we cannot but feel how much this ill-spent money would have stood them and their families in good stead in times of depression, and when the doors of the workshops were closed, had it been placed in a Savings Bank.

ENGLISH MANUFACTURERS AND FOREIGN COMPETITION.

What English mechanics think on business prospects and reciprocity:—

To the Editor of MARTINEAU & SMITH'S HARDWARE TRADE JOURNAL.

SIR,—Your article on the prospects of our staple industries draws attention to several important points. But there are one or two suggestions I would make to English manufacturers. When they see a foreign article gradually superseding their own, they should at once alter their style, and by putting down proper machinery, seek not only to beat their rival in England, but, if tariff permit, bid for foreign trade.

Hundreds of articles are being poured *wholesale* into this country which ought to be made here at a profit if made by suitable machinery, worked by labourers, who must not expect more than their rivals abroad, or they cannot have employment. Every shop is now stocked with foreign goods, and on the one hand we see shiploads of foreign manufactures, while thousands of starving mechanics stand idle.

Our working classes must now begin to see that *unless* they work at the same price their foreign competitors are content with, they cannot expect employment.

Yours truly,

THOS. M. BEAR.

Britannia Works, Colchester, Jan., 1879.

THE DEMAND FOR RECIPROCITY.

To the Editor of MARTINEAU & SMITH'S HARDWARE TRADE JOURNAL.

SIR,—Your leading article on "The Look-out Ahead," must have been read everywhere with no little interest. You seem to think, however, that by putting a stop to all bribery and corruption, by treating our mayors with proper respect, and by "putting mind into our work," we shall be able to keep level with the keen wits in other countries, and "need not fear extinction." This is all very well as far as it goes; but to my mind it does not go far enough. It is useless for us to try and do all these things if our rulers do not help us. We are supposed to govern ourselves, but if we did, do you think we should allow the manufactures of other countries to be sold here while our poor working men have nothing to do, and their wives and children are starving for bread?

It is all very well for you, Mr. Editor, sitting snugly by your fireside, and writing about the acquisition of "technical education founded on sound scientific acquirement; appreciation of beauty, learned by study of art;" it is all very fine for you to write in this way, but, "while the grass is growing, the steed is starving." Our rulers ought to have seen that we had the means of acquiring technical education years ago, and not have let other countries get ahead of us; but as they have done so, the thing that should be done is to tax the manufactures of other countries, and not let them in to cause the final "extinction" of those who can only get half a living now. Here we buy American corn, oil, cotton, and a little hardware and other manufactured goods; and we let all these things in free, while they charge sixty per cent. and more on our goods. I don't want to go back on Free Trade entirely, but let us have "Reciprocity."

What are the Germans doing? They see the error of their ways fast enough, and they are not going to let their manufacturers be undersold. Why can't we follow their example? If any man in Europ knows his way about, it is Bismark, and he would not recommend going back to Protection unless he was quite sure it was the right thing. Look at America, too. Why, by adopting Protection they have been able to make their "greenbacks" worth half as much again as they were ten years ago. Why, sir, if we were to have Reciprocity, I would undertake to say in a year's time we should all have full work again.

I am, Sir, yours respectfully,

A WORKING MAN.

[We publish this letter, although full of what we think dangerous fallacies. Our correspondent should remember that "Reciprocity" simply means buying dear—in homely words, "cutting off our noses to spite our faces." We have treated the subject from our point of view in a leading article; but we should be glad to have the expression of their views from other correspondents.

—EDITOR.]

A MOUNTAIN SINKING.—It is not uncommon in the Gulf and Southeastern Atlantic States for large bodies of land to sink below their original levels, but such phenomena have generally occurred in the low and sandy countries. The Toccoa (Georgia) *Herald*, however, reports the subsidence of a whole mountain in that country which is composed of, at least, half rock. A heavy storm was felt on the 20th of March accompanied by thunder and lightning and a terrible shaking of the ground. Immediately following this, it was found that the whole north side of Chattoogo mountain, sloping down at an angle of 45 degrees to the Chattoogo river and 1,200 feet in hight, was gradually sinking. There was a break near the top, and at one point, over the top of a sloping ridge, a perpendicular rock showed itself, the depth of which was about 16 feet and the extent 30 or 40 acres. The bank was in the form of a horseshoe, the toe being at the top of the mountain. Trees were standing with their roots up, and large stones cast out upon the surface. About three years ago an earthquake cracked the mountain at the point where the present break occurred, but no notice was taken of it at the time. Some fear is manifested by the inhabitants as to the results of this subsidence and the depth to which it may extend.

STEEL-FACED IRON PLATES.—A cast-iron mould is divided into two sections by means of a transverse plate of thin sheet-iron. The two metals are then poured into the respective compartments. The sheet-iron partition prevents the mixture of the metals and facilitates the welding by itself being brought into a state of fusion. It is said that the product is well adapted for safes, and that it resists drills.

FIG. 1.—ACCIDENT TO A STAG IN WINDSOR PARK.

FIG. 2.—FORE LEG OF STAG CAUGHT BY FORKED BRANCHES.

REMARKABLE ACCIDENT TO A RED DEER.

The accompanying engravings represent a curious mishap to one of the red deer in Windsor Park, the following account of which is given by Mr. Frank Buckland, in *Land and Water:*

On the 16th of January last, one of the keepers who has charge of the deer in the royal domains was going his rounds, when he suddenly came upon the scene as represented in Fig. 1. A magnificent red deer was lying on his back, with his leg tightly fixed in the forked branch of a white-thorn tree. This unfortunate animal was lying on his near or left side, with the tip of his right shoulder resting against the trunk of the tree. The chest and fore part of his body were clear of the ground, suspended by his right or off foot in the fork of the tree. Immediate examination showed the keeper exactly what we see in the engraving, Fig. 2, except that the body of the animal (in the engraving) is no longer attached to the foot. The keeper attempted to remove the foot, but found it so tightly fixed that with all his force he was quite unable to do so. The shank bone of the stag's foot was fractured and splintered diagonally. The fractured bones had made their exit by a cut through the skin, thus causing a compound comminuted fracture. The portion of the bone below this fracture—tough and strong as the red deer's shanks are—was shattered into minute fragments the size of dice. The bone was again fractured at its lower part, and the thick skin entirely lacerated through. The large sinews at the back of the bone, as well as the wire-like sinews that work the toes of the foot, were elongated and pulled out, and in fact everything was broken right off except two very slender sinews and a small portion of the skin. The total length of the portion of the deer's leg caught in the tree is seventeen inches; from the fracture to where it was torn off, eight inches. The leg was caught by the branches of the tree about four feet from the ground, and the lowest boughs carrying leaves were about nine feet from the ground. The deer was dead, and it is not known how long he had been held a prisoner by his foot.

As there were no eye-witnesses as to how this occurred to the stag, it becomes somewhat difficult to account for this extraordinary event. It is probable, however, that in consequence of the weather the animal was short of food, and that in his wanderings he had observed above his head something edible on the lower branches of the thorn tree, possibly leaves, moss, or lichens, on which deer feed in snowy weather. These he could not reach when standing on all fours. He, therefore, probably raised himself upon his hind legs, and when stretching himself upward and forward, the hoofs of his hind legs slipped from under him, or else, when letting himself down again, his right leg slipped suddenly between the forked branches of the tree, and was instantly held there tight. The animal then probably began immediately to struggle, but the more he kicked and fought the tighter the wrist of his foot got wedged in ; in fact, when the preparation was brought to me the foot was so tightly fixed into the notch of the tree that it could not have been more jammed if it had been hammered down, and then a long screw passed through it. In his struggles to get loose the first thing that happened was the fracture of the leg bone. This allowed the animal to fall on his back, from which position, of course, he could not rise. Terribly alarmed at what had happened to him, the poor stag then began to pull and tug at his captive leg, assisting himself so to do by means of his horns. In his frantic exertions to get free, the stag a second time broke his leg, then the skin gave way, and lastly, the large tendons. If his strength had lasted long enough to have ruptured the two small tendons, it is possible that he might have escaped, leaving his leg in the fork of the tree. Prince Christian, having been informed of the accident, judiciously ordered the portion of the tree which held the foot to be sawn off bodily. He then kindly sent the whole thing to me, with a request that the foot should be preserved for him without being removed from the fork in which it had been so tightly jammed by the animal itself.

The preparation will be the most unique specimen of an accident that ever occurred in the royal forest in the annals of English history.

THE ANTIQUITY OF MAN.

By Sydney B. J. Skertchly, F.G.S., of H.M. Geological Survey.

The written history of our land commences with the Roman occupation in the early part of the Christian era. The Keltic tribes which then inhabited England have long been looked upon as savages running wild in a wood, and exhibiting their woad-stained bodies to their friends with a paucity of clothing that should have called forth vigorous remonstrance from the whilom Lord Chamberlain. But these ideas are fast dying out amongst students, and it is becoming clear that no small degree of culture and civilisation appertained to them, and that the Roman occupation exercised rather a degrading than an elevating influence upon our ancestors.

These early Britons were skilled workmen in metal. They possessed good roads, built well-constructed towns, engaged in extensive foreign commerce, struck their own coins, and possessed a literature (alas ! totally lost) written in Greek characters. Perhaps no better proof of their culture can be adduced than their voluntary submission to the rule of a woman. Speed, translating Tacitus, gives us a splendid picture of Boadicea, who, "in her chariot, doing the parts of a most noble *Generall* drove from troope to troope to see and commend their *forwardnesse;* and dismounting, attended with her two daughters, and two hundred and thirty thousand *Britaines*, gat her to a seat made of marish turfes. . . . apparelled in a loose gowne of changeable colours, wearing a *Kirtle* thereunder, very thick *pleited*, the tresses of her yellow haire hanging down to the *skirts*. About her necke shee had a chaine of gold, and in her hand a light *speare*, being of personage tall, and of a comely, cheerful countenance."

This is no picture of savagery ; and we may rest assured that, whatever might be said of some of the inland tribes, the inhabitants of the coast were a very well conditioned people, of much culture. Such is the earliest notice of our forefathers.

Where history fails us, science takes up the tale, and carries us backwards to the most remote antiquity. The story is very far from complete, but it possesses the inestimable merit of adhering to the plain unvarnished truth, free from every touch of partisanship.

In the barrows and tumuli, in the stone circles and dolmens, and even preserved in morasses now reclaimed, we come upon the relics of the prehistoric peoples. Further back yet, in the gravels of the present rivers, and, as will be shown, in gravels of rivers now no more ; even under beds of glacial drift, and associated with extinct animals, articles of human workmanship are found.

Space will not permit us to dwell upon the times immediately anterior to the historic age ; but it is proposed to enter somewhat fully into the question of man's antiquity, and so expound the geological reasoning which has led some geologists—an increasing host—to date man's appearance in England some two hundred thousand years ago, long before the close of that wonderful epoch known as the Glacial Epoch.

Before Iron was known in England, Bronze was used for metallic weapons ; and strange as it may appear, a Bronze Age preceded the Iron Age all over Eurasia and over some parts of Africa.

Nor is this testimony altogether unsupported by historical evidence. In ancient Egypt, for instance, no iron implements are recognized as being older than the twelfth dynasty, whereas copper-mines dating as far back as the second dynasty are known in Wady Magarha, and old Latin writers speak of bronze chisels found in old Egyptian gold-mines, which were used before iron was known.

In ancient Greece the heroes are stated to have been equipped with bronze weapons, and the truth of this tradition has been abundantly proved by the splendid researches of Schlieman on the site of Troy. The very names, *chalkeys* and *chalkeyein*, used to designate working in iron, show that the old terminology of a former Bronze age had lingered on. Old Roman writers bear similar testimony to the priority of the use of bronze.

The great difficulty in accepting this testimony has always been in the irreducible nature of copper and tin ores as compared with those of iron ; and the complexity of an alloy like bronze, as distinguished from the simplicity of a single metal like iron.

It is, indeed, true that, as a rule, simplicity is a test of antiquity ; but the evidence in this particular instance is so weighty that we are bound to admit that, as a matter of fact, complex bronze did actually precede simple iron.

The geological testimony upon this point is singularly clear. In Denmark, where the succession of the Iron, Bronze and Stone ages was first satisfactorily determined, there are immense deposits of thick peat ; and, buried in this peat at different depths, are three successive forests.

The lowest of these forests is composed of trunks of the Scotch fir—a tree not now indigenous to Denmark. Associated with this forest are found remains of man, such as bones and weapons of stone—but never a trace of any metallic tool.

The pines seem to have died away from Denmark, and to have been succeeded by oak-trees, whose relics are found in the peat above the horizon of the pines. With these oak trunks are found weapons of bronze, but none of iron.

The oaks in their turn gave way, and were succeeded by beech-trees, whose relics form the third and highest of the zones of buried forests. Associated with these beech-trees occur tools of iron.

Here, then, we have clear geological proof of the intercalation of the Bronze period between the age of Stone and that of Iron ; and similar evidence might be cited from other localities.

But perhaps the strongest testimony in favour of the adopted classification is afforded by the nature of the tools themselves. Implements, like other things, have not suddenly been designed, but have gradually been developed ; the simpler forms having preceded the more elaborate as skill and culture advanced. If, then, bronze succeeded stone, we might reasonably expect to find some of the bronze tools fashioned after the type of pre-existing stone implements. This is actually the case. The finely-wrought stone axes known as celts have been copied in every feature by the workers in bronze ; and, as if to leave no room for doubt on this point, we find that bronze tools were afterwards copied in iron.

These facts teach us a more important lesson even than the succession of stone, bronze and iron. They show us that from the Stone Age man has occupied our land continuously and has progressed steadily in arts and civilisation.

We must here pause to remark that the Stone Age of which we are now speaking is known as the *Neolithic*, or Newer Stone Age ; and that there was an older, or *Palæolithic* Age, whose features will be hereafter discussed.

Let us now glance at the evidence that has been accumulated respecting the physical characteristics and habits of these prehistoric people. It would be quite out of our province to attempt, even in the most meagre manner, to epitomise the various trains of reasoning, founded upon discoveries all over Europe and elsewhere, that have brought our knowledge to its present state. We can, indeed, do little more than give bare results.

Over Great Britain and Ireland remains of the Neolithic and Bronze Ages are scattered broadcast. In the tumuli we have their burial-places, in certain caves their dwellings, and from the study of these and kindred relics we have been able to build up a more or less connected history.

The richest stores upon which we have been able to draw are preserved on the borders of the Swiss lakes, and for twenty years have yielded materials of the greatest interest.

It appears that in Switzerland, and, indeed, in other places, the prehistoric people lived in wooden dwellings, erected on platforms, supported by piles driven into the bed of a lake at a short distance from the shore. Similar lake-dwellings are still in use in the East Indies. Many of the ancient villages were destroyed by fire, and to these calamities we are indebted for our knowledge, for the household goods sank to the bottom and were preserved by the growing peat, even the charred fragments being still recognisable.

The first point of interest is the comparative rarity of human bones belonging to the Bronze Age. This holds good for the whole of Europe, and is explained by the custom of burning the dead. That cremation was in vogue among the Bronze folk is rendered certain by the discovery of the preserved calcined bones in tumuli belonging to the period. Skeletons of this age are not entirely missing, and it appears that the race was composed of tall individuals, with broad skulls and small hands. The latter fact being attested by the small size of the handles of the tools.

The Neolithic people, on the other hand, did not practise cremation, but buried their dead in a contracted posture, which may have been due to the position in which they died, some races to this day sleeping in a crouching attitude. This posture of the dead distinguishes Neolithic interments from those of the Iron Age, it being the custom at that time to bury the dead in an extended position.

The stature of the Neoliths was less than that of their successors, averaging about 5 ft. 5 in. They belonged to the long-headed varieties of the human race.

Very careful studies have been made of the skeletons of these early people, and it is abundantly clear that two distinct races existed. The Bronze folk agree in all respects with the well-known Keltic type, and we may infer that the people were fair, blue-eyed, and yellow-haired.

The Neolithic race, on the other hand, agree in all respects with that singular race to which the name of *Melanchroi*, or dark Kelts, has been given by Professor Huxley. These people are known to us historically and at the present time under various tribal designations. The Basques of South-western France and North-eastern Spain, and the Berbers and Kabyles of Northern Africa belong to this race; as did also the Guanches, or former inhabitants of the Canary Isles, of whose gentle demeanour and simple habits the Spaniards, who exterminated them, tell such touching stories.

This race was distinguished by their swarthy complexion, dark eyes, and long, black hair. They formerly spread all over Europe and Northern Asia, and seem to have come from Asia, forming part of the great Turanian people.

These dark Kelts, possessing no knowledge of metals, appear to have been invaded and conquered by the stronger, better-equipped, fair Kelts, before whom many fled to the mountain fastnesses of the land, where their descendants may still be recognised in the short, dark-eyed, black-haired, oval-faced people of Wales and parts of Ireland.

The conquest was one of fusion, and not of extermination, as their relics testify; and Cæsar and Tacitus each relate that Britain was occupied both by fair and dark people.

In our next paper we will examine into the habits of these early races, and the attempts that have been made to fix a chronology.—*English Mechanic.*

TRANSMITTING POWER BY SHAFTING.

In order to transmit the motion and power of a shaft, fitted in bearings, to one or more shafts occupying any desired and changeable position, Mr. Wilhelm Ritter, of Altona, Germany, proposes over one of the ends of a motive power shaft to place a box of a right-angle shaped bracket, and a conical wheel fastened to the outer end of this shaft. The other angle of the bracket is likewise formed as a box, the outer part of the boring being enlarged for the reception of a cylindrical prolongation of a similar bracket, and is furnished with a set screw to secure the second bracket, which can be turned within the enlarged boring of the first one in any desired position of a circle. A short axle passes through the box of the second bracket, the corresponding projection and the box of the first bracket, and each end of this short axle is furnished with a conical wheel fastened to it, and one of these wheels is in gear with the before-described wheel of the motive-power shaft, while the other conical wheel is in gear with a similar wheel fastened to the end of a shaft that revolves in the boring of the other box of the second right-angle bracket. By means of this gearing the shaft of the second bracket is put in motion, and the axis of this shaft can be turned into any position within the plane of a circle, after loosening the before-mentioned set screw, and turning the second bracket in the boring of the first one. After having brought the shaft of the second bracket in the desired direction, the position of the two brackets to each other is secured by means of the set screw. By means of two further pair of conical wheels, two more angle brackets of similar construction and connection, and another short axle, the transmission can be continued upon a third shaft, and the movableness of this third shaft will be greatly increased. The transmission of motion and power can in such manner be continued as far as necessary to other shafts, and the end of the last shaft may be constructed for the reception of a tool, or a pulley may be placed upon this shaft for driving a tool or implement. The conical wheels can be furnished with protecting covers.

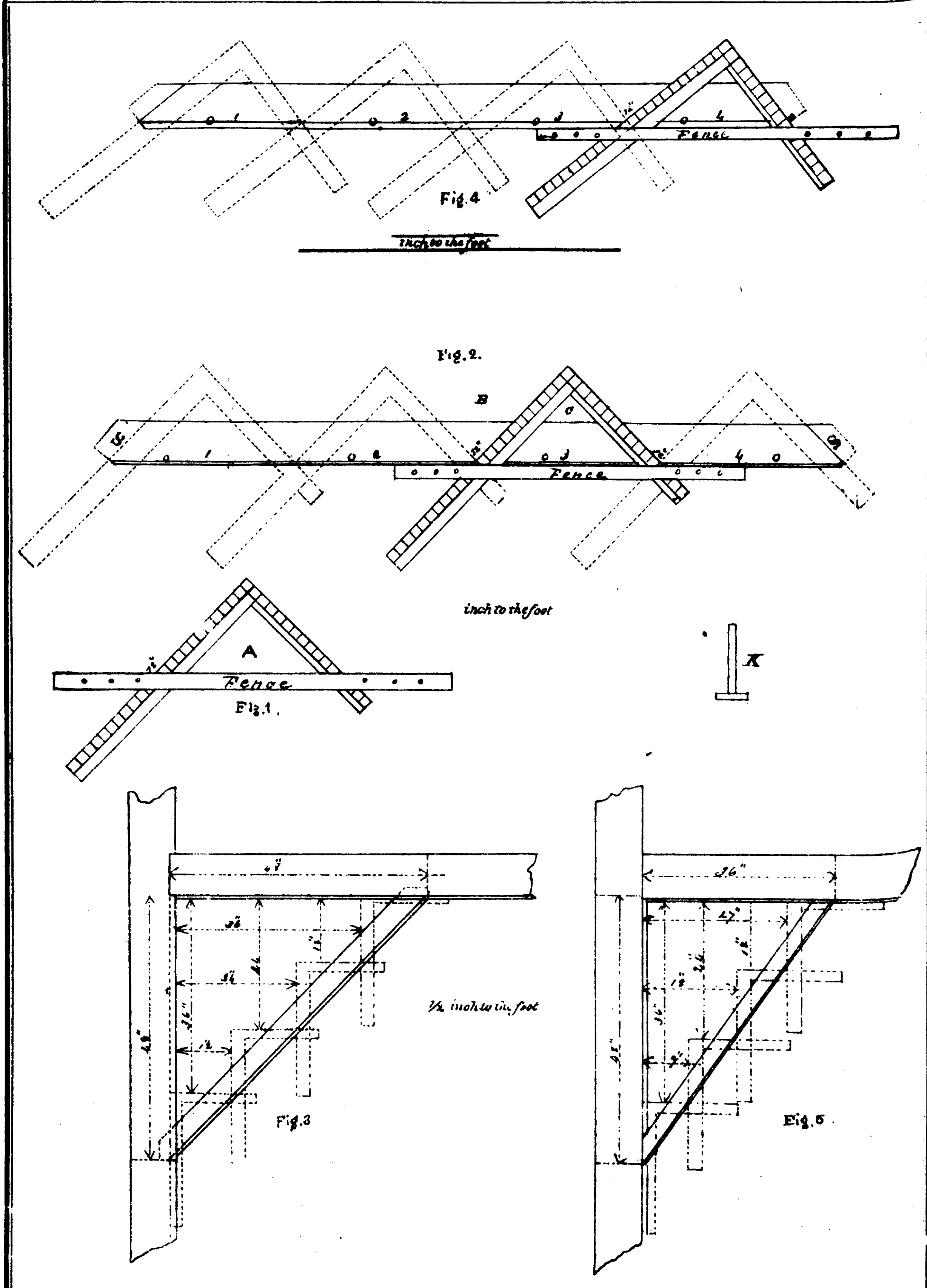
AN INDELIBLE WRITING AND CANCELLING INK.

Improvements in writing and cancelling inks have been patented in this country recently by Messrs. H. and W. S. Richmond, of New York city. Intended mainly to supply indelible cancelling inks, well adapted for marking postage and other stamps, they can, by suitable dilution, be used for legal, commercial, and other writings, in which permanency of the ink is of importance. The inks consist of the following ingredients, namely:—Eosine, aniline black, aniline blue, cupric chloride, sodium chlorate, ammonium chloride (sal-ammoniac), glycerine, lampblack, water, and oil. These substances are taken in the following proportions:—Eosine, one part; aniline black, four parts; aniline blue, two parts; cupric chloride, one part; ammonium chloride, three parts; sodium chlorate, two parts; and of the remaining ingredients a sufficient quantity to bring the ink to the proper consistency for the use for which it is intended. The ingredients are thoroughly incorporated by grinding or stirring, when the composition is ready for use. The ink described is absolutely indelible. Stamps cancelled therewith are effectually destroyed, and the fraudulent alteration of matter written therewith is impossible. The rationale of the operation of the ink is as follows:—Besides having as an ingredient aniline black, it embodies also the substances necessary to produce that colour—to wit, an aniline, an oxidising agent, and a cupric salt. The re-action of these substances is, however, retarded by the oil, which also forms a part of the ink. As a consequence the aniline black, which is a product of the reaction of the ingredients of the ink, is partly formed within the body of the stamp paper.

In preparing the composition for ordinary writing ink, the oil and lampblack are preferably omitted, a small portion of gum arabic being added in their stead, the latter subserving the same end as the oil. To prevent moulding a small proportion of some antiseptic agent, such as salicylic acid, may also be added. The inventors are aware that it is not new to employ aniline black, or its homologues, in inks, and therefore do not claim it, their invention consisting essentially in such a compound as contains the ingredients for forming aniline black, and for retarding the reaction sufficiently to defer its completion until after the ink shall have been applied to the paper or surface upon which it is to be used.

A writer to the *English Mechanic* gives the following instructions for making concrete:

"Having made a good many experiments in concrete, I found that I best succeeded by observing the following rules:—1st. To use stones neither too large nor too fine, but an average mixture. 2nd. That they should be free from sand or earth, angular stones to be preferred to round, so if a stone-crusher can be used so much the better. 3rd. Mix no sand with cement, and use the best articles. 4th. I built a wall, seven inches thick, with seven parts of "beach shingle" and one of cement, and find it very strong. 5th. Avoid using more than enough water to moisten stones and cement, after they have been stirred over previously so that each stone is covered; if too much water, the cement settles at the bottom of each new coat, making the work look streaky. Never make more up at a time than needed. Use weights for stones, cement, and water, rather than measures. Age confers strength on concrete. Let each layer get well set before shifting shield or planks for a fresh course."



THE CARPENTER'S STEEL SQUARE AND ITS USES.

THE CARPENTER'S "STEEL SQUARE" AND ITS USES.

BY T. F. HODGSON.

We have recently given two illustrations of the uses of the steel square, and we feel much pleasure now in publishing in full an article which appeared some time since in the *American Builder* by T. F. Hodgson, Architect, Collingwood, Ontario. We regret that we have not space to insert the preliminary remarks made by Mr. Hodgson on this subject, but will proceed direct to the description, given by the writer, how this useful instrument is the best that can be used when properly understood and applied. Such is Mr. Hodgson's statement from 24 years of practical application, both in the United States and Canada, in the erection of many large timber structures :—

The "Square," as a constructive tool, must of necessity have found a place in the "kit" of the earliest builders. Evidences of its presence have been found in the ruins of pre-historic nations, and are abundant in the remains of ancient Petra, Ninevah, Babylon, Etruria, and India. South American ruins of great antiquity in Brazil, Peru, and other places, show that the unknown races that once inhabited the South American Continent, were well posted in the use of the square. Egypt, however, that cradle of all the arts, furnishes us with the most numerous, and, perhaps, the most ancient instances of the use of the square; paintings and inscriptions on the rock-cut tombs, the temples, and other works, showing its use and application, are plentiful. In one instance, a whole "kit" of tools was found in a tomb at Thebes, which consisted of mallets, hammers, bronze nails, small tools, drills, hatches, adzes, squares, chisels, etc.; one bronze saw and one adze had the name of Thothmes III., of the 18th dynasty, stamped on their blades, showing that they were made nearly 3,500 years ago. The constructive and decorative arts at that time were in their zenith in Egypt, and must have taken at least 1,000 years to reach that stage. Consequently, the square must have been used by the workmen of that country four thousand years ago.

The British Museum contains many tools of pre-historic origin, and the square is not the least of them. Herculaneum and Pompeii contribute evidences of the importance of this useful tool. On some of the paintings recently discovered in those cities, the different artisans can be seen at home in their own workshops, with their work-benches, saw-horses, tools, and surrounding, much about the same as we would find a small carpenter's shop of to-day, where all work is done by hand; the only difference being a change in the form of some of the tools, which, in some instances, had been better left as these old workmen designed them.

The young mechanic will now come with me to the workshop, and he and I will talk over this steel square matter in a free and easy manner. We first examine the "Tool" that we are to work with. We find that there has been good judgment displayed in its purchase; the blade is exactly 2 inches wide and 24 inches long, the tongue is 1½ inches wide and 18 inches long; it lies on the work-bench before us with the blade running from the right hand to the left, and the tongue pointing from us. On close examination we find that the inches on the upper side, as it lies on the bench, are divided into twelfths, which form a convenient scale. This division occurs all round the outside edge of blade and tongue. The other edge of this side of the square is divided into quarters of an inch. When the tool is turned over, we find that the outside edge is laid off into sixteenths, and the inside edge into eights. The board rule, which often is of use to the carpenter, is laid off on one side; the brace rule and diagonal decimal scale are found on the tongue. To insure good work and true, it was necessary to be careful in selecting this square, to see that the tongue was exactly at right-angles with the blade, or, in other words, to see that it was square. To test this question, we get a board, about 12 or 14 inches wide, and four feet long, dress it on one side, true up one edge as near straight as it is possible to make it. We lay the board on the bench, with the dressed side up, and the trued edge towards us; we then apply the square, with the blade to our left, and mark across the prepared board with a penknife blade, pressing close against the edge of the tongue; this process done to our satisfaction, we reverse the square, and move it until the tongue is close up to the knife mark, we find that the edge of the tongue and the mark coincide, which is proof that the tool is correct enough for our purposes. Being satisfied on this point, our next step will be to prepare what we shall call, for the want of a better name, an adjustable fence. This is made out of a piece of black walnut or cherry 2 inches wide, and 2 feet 10 inches long (being cut so that it will pack in our tool chest), and 1⅝ inches thick; we run a saw kerf cutting down these guage lines at least one foot from each end, leaving about ten inches of solid wood in the centre of fence. We now take our square and insert the blade in the saw kerf at one end of the fence, and the tongue in the kerf, at the other, the fence forming the third of a right-angle triangle, the blade and the tongue of the square forming the other two sides. Our next step will be to make some provision for holding the fence tight on the square; this is done by putting a No. 10 1½-inch screw in each end of the fence, close up to the blade and tongue; having done this, we are ready to proceed to business.

We will now take the square and the fence as shown at A, leaving the fence loose for further adjustment.

Our first attempt will be to make a pattern for a brace, for a four-foot "run." Taking a piece already prepared, six feet long, four inches wide and half-inch thick, guage it three-eighths from jointed edge.

We take the square as arranged at A, and place it on the prepared stuff, as shown at *c*, Fig. 2. Adjust the square so that the twelve-inch lines coincide exactly with the gauge-line 0, 0, 0, 0. Hold the square firmly in the position now obtained, and slide the fence up the shank and blade until it fits snugly against the jointed edge of the prepared stuff, screw the fence tight on the square, and be sure that the 12″ marks on both the blade and the shank are in exact position over the gauge-line.

I repeat this caution, because the successful completion of the work depends on exactness at this stage.

We are now ready to lay out the pattern. Slide the square to the extreme left, as shown on the dotted lines at *x*, mark with a knife on the outside edges of the square, cutting the gauge-line. Slide the square to the right until the 12″ mark in the shank stands over the knife mark on the gauge-line; mark the right-hand side of the square cutting the gauge-line as before, repeat the process four times, marking the extreme ends to cut off, and we have the length of the brace and the bevels.

Square over, with a try square, at each end from the gauge-line, and we have the toe of the brace. The dotted lines, *s*, *s*, shown at the ends of the pattern, represent the tenons that are to be left on the braces. This pattern is now complete; to make it handy for use, however, we will nail a strip 2" wide on its edge, to answer for a fence as shown at *k*, and the pattern can then be used either side up.

The cut at Fig. 3 shows the brace in position, on a reduced scale. The principle on which the square works in the formation of a brace can easily be understood from this cut, as the dotted lines show the position the square was in when we laid out the pattern.

We hope that it is unnecessary to inform the young student, that the "square" as now arranged, will lay out a brace pattern for any length, if the angle is right, and the *run* equal. Should the brace be of great length, however, additional care must be taken in the adjustment of the square, for should there be any departure from truth, that departure will be repeated every time we move the square, and where it wouldn't affect a short run.

We will now endeavour to lay out a pattern for a brace with an irregular run. We want a pattern for a brace where the run on the beam is three feet, and the run down the post four.

Prepare a piece of stuff, same as the one operated on for four feet *run*, joint and gauge it. Lay the square on the left hand side, keep the 12" mark on the shank, over the gauge-line, place the 9" mark on the blade, on the gauge-line, so that the gauge line forms the third side of a right-angle triangle, the other sides of which are nine and twelve inches respectively.

We now proceed as on the former occasion, and as shown at Fig. 4, taking care to mark the bevels at the extreme ends. The dotted lines show the positions of the square, as the pattern is being laid out.

Fig. 5 shows the brace in position, the dotted lines show where the square was placed on the pattern. The young student will do well to thoroughly understand the obtaining the lengths and bevels of irregular braces; by a little study he will soon be able to make all kinds of braces.

If I want a brace with a two feet run and a four feet run, it must be evident that, as two is the half of four, so on the square we must take 12" on the shank, and 6" on the blade, apply four times, and we have the length, and the bevels of a brace for this run.

For a three by four run, we take 12" on the shank, and 9" on the blade, and apply four times, because, as 3 feet is ¾ of four feet, so 9" is ¾ of 12".

From these few examples, it is hoped that all enquirers may be able to master this method of laying out braces. Should there be any fellow-workman, however, who does not fully understand this system, and who is desirous of further information on the subject, he will always find us willing to answer.

Next month we propose dealing with the "Rafter question," and we venture to predict, that what appears to be a great mystery to the young and inexperienced workman, will resolve into a very simple matter.

(*To be continued.*)

A Giant Tree.—A patriarch of the forest has been lately felled in California, and the greater portion of the wood taken to San Francisco. It was known by the epithet of "Old Moses." If one might infer with accuracy its age from the number of its rings, it must have been 4,840 years old. Its capacity is said to have been so great that 300 persons could find room within its trunk.

Useful Information.

Sights Seen from a Railroad Train.—Some new optical delusions have been described by Dr. L. P. Thompson. Those connected with the railroad may serve to relieve the tedium of travel by affording an agreeable exercise to the mind in endeavoring to explain them. When a landscape is observed from a moving train, all objects to the remote horizon appear to be passing in the contrary direction, those nearest having the greatest velocity. Consequently, if the attention be fixed upon any object at some distance from the line, all objects beyond will relatively appear to be moving forward with the train, while objects nearer appear to be moving backwards. The combined effect is to make the landscape appear to be revolving centrally round whatever point we fix our attention upon. Rain seen from a moving train always seems to be falling obliquely (except in a very strong gale in the direction of the train's motion) in a direction opposite to that of the motion of the train. But if another train happens to pass in the opposite direction, and we look out at this and follow it with our eyes, raindrops falling between the two trains will seem to be flying forward with ourselves. If we stand upon the platform of a station and watch a train approach, the end of the engine appears to enlarge or swell as it approaches, and occupies a larger area of the field of vision. Conversely the end of the last car on a returning train appears to shrink down and contract as it diminishes in apparent magnitude. An observer at some slight elevation above a railroad, seeing two trains pass along simultaneously in opposite directions, will receive the impression of one long train moving round a circle.

New Nickel-Plating Solution not Patented.—In view of the recent decision in regard to nickel-plating, the following information from the *Manufacturer and Builder* may be found of useful interest: Messrs. Boynton, Wiler & Co., in England, have for sale a new nickel-plating solution, which they confidently recommend for the following reasons: 1st. It is a solution of the double salt of cyanide of nickel and potassium, and consequently not a solution which is used and prepared by the alleged Adams process. 2nd. It will plate on all metals directly, including zinc, lead and solder, and penetrates deeply into the pores of the cathode, thereby preventing oxidation. 3rd. It will positively plate faster than any known process; sometimes in about eight minutes. 4th. It never requires a special regulation by electricity, thereby preventing the burning of the smallest articles by the strongest currents. 5th. Articles to be plated never become injured from oxidation in the solution. 6th. It produces a coherent, tenacious and flexible deposit, superior to any known to science. 7th. No acid dips are required for any kind of work, while Dr. Adams claims that acid dips are very essential for good results. 8th. The expense of keeping the solution in perfect working order does not exceed $5 per 100 gallons per month, if ordinary care is used, as in all other solutions. They are prepared to sell this solution on favorable terms, thereby dispensing with the license or royalty business altogether.

To Make a Razor Strop.—Select a piece of satin, maple, or rose wood, 12 inches long, 1⅝ inches wide, and ⅜ inch thick; allow 3½ inches for length of handle. Half an inch from where the handle begins, notch out the thickness of the leather so as to make it flush toward the end. Taper also the thickness of the leather; this precaution prevents the case from tearing up the leather in putting the strop in. Then round the wood very slightly, just enough (say one-twelfth of an inch) to keep from cutting by the razor in stropping and turning over the same. Now select a proper sized piece of French bookbinder's calfskin, cover with good wheat or rye paste, then lay the edge in the notch, and secure it in place with a small vice, proceed to rub it down firmly and as solid as possible with a tooth-brush handle (always at hand, or should be), and, after the whole is thoroughly dry, trim it neatly and make the case.

Bronzing Wood, Leather, Paper, Etc.— The *Moniteur Industriel*, of Paris, describes a process for bronzing wood, leather, paper, etc., as follows: The inventor dissolves gum lac in four parts by volume of pure alcohol, and then adds bronze or any other metal powder in the proportion of one part to three parts of the solution. The surface to be covered must be very smooth. In the case of wood, one or several cats of Meudon or Spanish white are given, and the object is polished with an iron of proper shape. The mixture is painted on, and when a sufficient number of coats have been given, the object is well rubbed. A special advantage of this process is that the coating obtained is not dull, but can be burnished. A transparent varnish is applied to preserve the metallic appearance thus obtained.

COLORING MATTER OF HAIR.—Mr. H. C. Sorby has succeeded in extracting the coloring matter from human hair. Diluted sulphuric acid he found the best solvent; he found that there are three coloring pigments—yellow, red and black—and that all the shades are produced by the mixture. In pure golden yellow hair there is only the yellow pigment; in red hair the red pigment is mixed with more or less yellow, producing the various shades of red and orange; in dark hair the black is always mixed with yellow and red, but the latter are overpowered by the black; and he found that even the blackest hair, such as that of the negro, contains as much red pigment as the very reddest hair. He concludes from this, that if in the negro the black pigment had not been developed the hair of all negroes would not be white or yellow, but as fiery a red as the reddest hair of an Englishman.

CEMENT FOR JOINING METALS WITH NON-METALLIC SUBSTANCES.—To obtain a cement 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 two and one-fourth pounds of glue and two ounces of gum ammoniac, adding, in small quantities, about two ounces of sulphuric acid.

GASES OF THE STOMACH.—In a paper recently read before the Paris Academy of Medicine, the author expressed the opinion that food does not produce gas, and that the gases which are found in the digestive tubes proceed from the external air, the blood and fecal matter; these gases are continually put in motion by the pathological contractions of the muscular fibers of the intestines; expelled by the mouth, they are constantly renewed, and their production may be as incessant in a starving man as in one who is well fed. This symptom of production of gas, therefore, signifies an irritation of the stomach, which is always consecutive to a long-standing gastric dyspepsia. No therapeutic agent need be sought to combat these gases.

PREVENTIVES OF LEAD COLIC.—If working in lead, wash the hands several times a day in a strong decoction of oak-bark. Keep the hair short, and (if a painter) wear a clean cloth cap. The clothes should be frequently washed, and the hands also, especially before touching food. Before eating the mouth should be rinsed with cold water. A weak oak-bark decoction should be used as a wash several times a week. The body should be sponged night and morning with cold or tepid water, and the hair thoroughly washed every evening after work. The food should contain a large proportion of fatty substances, and milk should be taken in large quantities.

HOW TO MAKE COURT-PLASTER—Soak isinglass in a little warm water for 24 hours, then evaporate nearly all the water by gentle heat, dissolve the residue in a little proof spirits wine, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Now stretch a piece of silk or sarsanet on a wooden frame, and fix it tight with tacks or pack-thread. Melt the jelly, and apply it to the silk thinly and evenly, with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is said to be very pliable and never breaks.

COSTLINESS OF FOOD.—Thousands of persons, we might say hundreds of thousands, in our great republic, begin life poor, live poor during life, and die poor because of the exceeding costliness of the foods they eat. Think of our eating butter at 35 cents a pound, when one can buy Indian corn at 60 cents a bushel. One bushel of hickory nuts has more oil in it than five pounds of butter. One bushel of Indian corn has more nutriment in it than $2 worth of the best beefsteak you can find. One bushel of real graham flour has more nutriment in it than a barrel of superfine flour and 50 pounds of beefsteak. We spend ever so much to live when it need cost us but little, and our health will be all the better.—*Exchange.*

EMERY BELTS AND WHEELS.—A correspondent says that most users of emery belts and emery wheels do not use glue that is thick enough, fearing it may chill before the sand or emery can be spread. In making an emery wheel or belt, if the cloth has never been glued, it should be sized with glue about as thick as lard oil, and allowed to dry thoroughly before applying the glue which holds the emery. Have the emery heated to 200° Fah., and coat the belt or wheel with glue about as thick as molasses and roll it in the hot emery. If a wheel or belt thus treated is allowed sufficient time to become thoroughly dry, it will be very serviceable.

HOW TO SUCCEED AS A MECHANIC.—Every mechanic should study to be progressive. He should study to make every new piece of work a little better, in some way, than the last similar work which he has turned out. An eminent French coachmaker says: "I never build two carriages exactly alike, not because I do not build each one as well as I know how, but in building that I learn how to make the next one better. When I placed these carriages of mine in the exposition building, I thought them perfect, but now that I have spent three months looking over the carriages of other builders, I see that they are not so." Here is an illustration of the value of close observation and study.

GALVANIC DESTRUCTION OF SHIPS.—In marine structures of any kind, or structures only occasionally at sea, great care should be taken to avoid the use or combination of copper, or its usual alloys, with iron or steel. The galvanic action set up by even indirect connection of these metals is productive of rapid corrosion and pitting. This has long been observed and well-known to many, but its truth, though now strongly asserting itself, has been neglected by the constructors of ships, and especially in the navy, where gun-metal screws of many tons weight are used.

TO TEMPER DRILLS.—Select none but the finest and best steel for your drills. In making them, never heat higher than a cherry red, and always hammer till nearly cold. Do all your hammering in one way, for if, after you have flattened your piece out, you attempt to hammer it back to a square or a round, you spoil it. When your drill is in proper shape, heat it to a cherry red, and thrust it into a piece of resin or into quicksilver. Some use a solution of cyanuret potassa and rain-water for tempering their drills, but for my part, I have always found the resin or quicksilver to work best.

WAX PENCILS.—Now that such enormous deposits of mineral wax have been found in Utah, it may be of interest to point to a minor use of this substance for wax pencils, which, it is stated, are made by an Austrian firm, Messrs. Olenheim, Griffen & Co., for marking and writing on all kinds of wood, linen, cloth, and paper, and as a substitute for chalk for blackboards. It is stated that the marks with these pencils are not obliterated by moisture or rubbing, nor are they affected by acids.

CLEANING SPONGES.—A gelatinous substance frequently forms in sponges after prolonged use in water. A weak solution of permanganate of potassa will remove it. The brown stain caused by the chemical can be got rid of by soaking in very dilute muriatic acid. An old and dirty sponge may be cleaned by first soaking it for some hours in a solution of permanganate of potassa, then squeezing it, and putting it into a weak solution of hydrochloric acid, one part acid to 10 parts of water.

GREASE SPOTS ON CLOTHING.—In using benzole or turpentine, people make the mistake of wetting the cloth with the turpentine and then rubbing it with a sponge or piece of cloth. The only way to radically remove grease spots is to place soft blotting paper beneath and on top of the grease spot, which spot has first been thoroughly saturated with the benzole, and then well pressed. The fat gets now dissolved and absorbed by the paper, and entirely removed from the clothing.

PURITY OF MILK.—It is stated in a German paper that the purity of milk may be tested by the following very simple method: A well polished knitting-needle is dipped into a deep vessel of milk and immediately withdrawn in an upright position; when, if the sample be pure, some of the fluid will be found to adhere to it, while such is not the case if water has been added to the milk, even in the smallest proportions.

SIMPLE MODE OF SILVERING METALS.—Small articles may easily be coated with silver by dipping them first into a solution of common salt, and rubbing with a mixture of one part of precipitated chloride of silver, two parts of potassa alum, eight parts of common salt, and the same quantity of cream of tartar. The article is then washed and dried with a soft rag.

TO TEMPER GRAVERS.—Gravers, and other instruments larger than drills, may be tempered in quicksilver as above; or you may use lead instead of quicksilver. Cut down into the lead, say half an inch; then, having heated your instrument to a light cherry red, press it firmly into the cut. The lead will melt around it, and an excellent temper will be imparted.

CABINET IN THE ROYAL PALACE IN MADRID.

AN ELEGANT CABINET.

When, under the reign of Louis XVI. (towards 1780), the true principles of art began to prevail again, the degenerated and capricious forms of the preceding epoch, under the Régence and Louis XV., disappeared gradually to make room for straight forms of a purer character, suggested by the revival of classical art. Nowhere more than in cabinet work and furniture do we remark this new tendency: classical entablatures replace the contorted forms of the Rococo; caryatides, acanthus leaves, and enriched mouldings in ormolu, plaques of porcelain, painted with pastoral scenes and flowers, cameo medallions in porcelain and glass, are introduced instead of the confused scroll work and unmeaning decoration of the style of Louis XV.

The piece of furniture represented here belongs to this style of art, and shows rich ornaments in bronze gilt and inlaid plaques of Sèvres porcelain, *pâte tendre*, with bouquets of flowers.

LIBRARIES. — The largest library in the world is stated to be the National Library at Paris, which in 1874 contained 2,000,000 printed books and 150,000 manuscripts. The British Museum and the Imperial Library at St. Petersburg both contained about 1,100,000 volumes in 1874, and the relation is probably the same now. The Royal Library of Munich contains 900,000 books. The Vatican Library at Rome is sometimes erroneously supposed to be among the largest, while in point of fact it is surpassed, so far as the number of volumes goes, by more than sixty European collections. It contains 105,000 printed books and 25,500 manuscripts. In the United States the largest is the Library of Congress at Washington, which in 1874 contained 261,000 volumes. The Boston Public followed very closely after it with 260,500 volumes, and the Harvard University collection came next with 200,000. The Astor and Mercantile, of New York, are next, each having 148,000. Among the colleges after Hayvard's Library comes Yale's with 100,000. Dartmouth's is next with 50,000, and then come in order Cornell with 40,000; the University of Virginia with 36,000; Bowdoin with 35,000; the University of South Carolina with 30,000; Ann Arbor, 30,000; Amherst, 29,000; Princeton, 28,000; Wesleyan, 25,500; and Columbia, 25,000.

THE WINDOW GARDEN.

Nothing adds more to the cheerful appearance of the interior of a house than an array of choice plants, but too frequently it happens that the hideous red pots containing them are permitted to stand out in bold relief, entirely neutralizing the pleasurable effect of the plants. Our engraving shows a beautiful plant stand, or window garden, which may receive the earth in which the plants are rooted, or the pots may be placed in it and hidden by it. The fish in the globe at the top give it life, and the whole forms a beautiful ornament for the window.

BIOPLASM.

Among the recent discoveries in science, none perhaps will prove of more utility to man than those relating to bioplasm, because they throw light on physiological questions, particularly those concerning the construction and nutrition of the body and the causes of disease. It was formerly supposed that our bodies were alive from top to toe, inside and out; but this is found to be a mistake. Only about one-fifth part is alive; the rest is formed material. Everybody knows that a tree may become so hollow that only a shell is left; yet the tree may grow and mature buds and leaves and fruit. It is because the outside of the tree—the bark—is alive; the wood is non-living; it is simply formed material. Now the body is not like the tree—alive only on the outside; but the living portion and the formed material exist together in every part—in every tissue, organ and vessel.

A slight abrasion of the cuticle, or the rupture of a cell, is followed by particles of fluid which were formerly overlooked as of no account. But the microscope has revealed to us that this apparently useless, insignificant ooze is the vital, living part of the body; it is *bioplasm*.

This is the mechanic, the skilled artist, that constructs the cells, builds the organ, and perhaps, under the direction of a higher power, adapts each part to one harmonious whole.

For the last 15 years certain English and German physiologists have spent much time with the microscope, watching this little workman. They have seen it forming tissue, muscle and nerve, changing food into blood, making the secretions; and, as part of the body became worn and effete, silently disintegrating and utilizing them, or removing the useless parts from the body.

The first decided knowledge of bioplasm came by accident (if finding a thing we are searching for can be called accident; is it not rather revelation ?), by ascertaining that when a piece of live tissue is immersed in a solution of carmine the bioplasm is stained, and the formed material is not stained. This discovery has enabled observers to find and watch this little workman, while busy in constructing every part of the body.

Bioplasm is the builder not only of the body, but of all animals and plants. To it every organized form, whether animal or vegetable, owes its formation and growth.

Bioplasm is a clear, colorless fluid, like thin mucus. Only microscopes of the highest power are of use in studying the substance; for the largest normal masses are not one-thousandth of an inch in diameter; but such microscopes fail to detect in it the least sign of organization.—*Journal of Chemistry.*

MAKING LUMBER FROM STRAW.

A person named S. H. Hamilton, of Bushnell, Illinois, has been in this city for two or three days past, with samples of lumber which has attracted much attention among the lumbermen and which, if it possesses all the virtues that are claimed for it, is one of the most important inventions of its kind ever brought to notice. If it is a success it will form a new era in the art of building. To make hard wood lumber out of common wheat straw, with all effects of polish and finish which is obtainable on the hardest of black walnut and mahogany, at as little cost as clear pine can be manufactured for, is certainly wonderful. Such are the claims of Mr. Hamilton for the straw board lumber which he has been exhibiting in this city, and the samples which he produces would go far towards verifying his claims. The process of manufacture, as explained by Mr. Hamilton, is as follows: Ordinary straw board, such as is manufactured at any paper mill, is used for this purpose. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution, which thoroughly softens up the fiber and completely saturates it. The whole is then passed through a succession of rollers, dried and hardened during the passage, as well as polished, and comes out of the other end of the machine hard, dry lumber, ready for use. Mr. Hamilton claims that the chemical properties hardening in the fibre entirely prevent water soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water. The samples which Mr. Hamilton exhibits could hardly be told from hard wood lumber, and sawing it the difference could not be detected. It is susceptible of a very high polish, and samples of imitation of marble, mahogany, etc., were shown, which might deceive the most experienced eye. Not only does Mr. Hamilton claim a substitute for lumber in sash, doors and blinds and finishing stuff, but also as a substitute for black walnut and other woods in the manufacture of all kinds of furniture, coffins, etc., and also an excellent substitute for marble in marble-top tables, mantle pieces, bureaus, etc. He claims that it will not warp in the least. Mr. Hamilton is negotiating with parties here, with the view of establishing a manufactory in this city for making the various articles of building material for which his lumber is suitable.--*Oshkosh, Wes., Northwestern.*

Sanitary.

HOW TO POISON A HOUSE.

The following, which we extract from the New York *Times*, agrees so well with our own ideas on the subject, that we cannot refrain from publishing it :—

"Many remarkable and sudden outbreaks of disease and cases of sudden death have occurred during the past few years in houses in New York, where every sanitary circumstance seemed favorable. The favorite child of a wealthy family has been suddenly carried off by diphtheria, where the house was on the hill with the drainage apparently excellent, and the rooms were never crowded or overheated. Another, living in the most airy and elevated portion of the city, has suddenly been seized with that most mysterious and terrible of the 'foul air diseases,' spinal meningitis, and, under every care and precaution which wealth could supply, has died in great agony. Here a family, living in what might be called a palatial house, has been attacked with typhoid, and the children or other members have struggled for months with death. Virulent fevers have broken out in the finest houses, and some of the handsomest quarters of the city have not been exempt from pestilential diseases. Malaria has been everywhere, and Fifth avenue has felt it as well as the streets made over old water pools. It should be remembered, too, in a sanitary point of view, that the best parts of New York ought to be utterly exempt from these foul-air diseases. There is nothing 'providential' in the sense of mystery in these sudden deaths of the children of the rich. They are as much the effect of law as would be the drowning of these same children, if they had been put under the water. Modern science can as certainly reduce the death-rate from foul-air diseases as it can elevate the land or keep down the water on the banks of a given lake. A skilful modern prison and sanitary inspector has said that if he discovered a case of small-pox or diphtheria in his wards, he should at once charge himself with defect of administration.

"The best parts of a city cannot, of course, escape the diffusion of poisonous gases from the worst parts. Moreover, nuisances like our gas works and bone factories contribute their poison for miles on every wind. But each house in New York has a private and individual machine for diffusing the germs of diphtheria or the seeds of scarlet fever, sore throat, cholera infantum and typhoid. Almost every bed-room in the richest quarters of the city has a private connection with the sewer, in which are the infecta of typhoid patients, or the fermenting and disorganizing animal and vegetable matter, which either produce the seeds of disease, or furnish the fertile soil for these seeds to ripen in. The especial means of infection in many diseases is by sewer products. In the Croton water-bowl there is, of course, a drain-pipe connected with the main drain of the house. Ordinarily the water-traps keep the gases back. But some night, when the sleeper is most unprotected against such influences, and the vital energy is at the lowest, a flood from the sea or rain fills the sewers, or a strong wind blows through them. The gases are forced violently back. The water in the trap-bend forms no obstacle. They rush up through the chamber water-pipes, and diffuse themselves through the apartment. Had we a supernatural power of sight, we should undoubtedly see on such a night a cloud of microscopic sporules of scarlet fever, or currents of diphtheria germs, or showers of typhoid seeds scattering themselves through the house, and entering the systems of the unhappy sleepers. Such as are vigorous would throw them off, but with the weak and the young the seeds would take root, spring up and bear fearful fruit. The next day there would be a 'providential' case of malignant fever in the house, and in a few weeks a life would be extinguished, whose loss many coming years could not cause to be forgotten.

"The only prevention against such escapes of gases is to banish all water drains from the bedrooms, and to put escape ventilation pipes on the traps. We must return to the old bowl and pitcher. The pipes should all end in the bath-room; all water be drawn from there, and this room ventilated so as to permit no contamination of the house. The little extra trouble would be well repaid by the safeguard to life. Such an arrangement excludes all chamber bath-rooms. But safety is the first thing, convenience afterward."

THE SANITARY CONDITION OF TENEMENT HOUSES.

It is a very sweeping assertion to say, yet I do say without the least hesitation, and fully understanding all that it implies, that every tenement house in New York or elsewhere which was built so long as five years ago ought to have its whole drainage system entirely removed and replaced by the very best work of which the modern art of plumbing is capable, arranged according to the very best plan which modern sanitary knowledge can devise. I date back five years as a saving clause. It is possible, but it certainly is not probable, that a few of the more modern tenement houses may be properly drained. The objection will naturally be raised that to compel the owners of these houses to undertake such costly work would be a hardship, if not an actual invasion of their private rights. The objection is of no value. Capitalists of the class under consideration depend for their income upon the necessities of ignorant, heedless, and helpless people,—of men, women, and children who hold their lives daily subject to the most imminent danger.

A great outcry is raised against the bad sewers of the older parts of all our cities, and they are bad enough to justify the outcry. At the same time, the houses connected with them get their bad effect only at arm's length, and they need not get it at all. As at present arranged, there is no doubt that they do receive an injurious amount of sewer gas from them. At the same time, there is just as little doubt that their own private drains, soil-pipes, and waste-pipes are active and constant producers of equally deleterious gases, sufficient to account for the unhealthy condition which is so often ascribed exclusively to the sewer in the street.

It would be a comparatively small matter so to disconnect every house from the sewer that it need be in no danger of an invasion of its gases. If only this were needed to remove the drain diseases which we know to be so rife, our problem would be a very simple one. Unfortunately what is needed is very much more serious than this, and must be very much more costly.

The health officers of every city know, or it is their duty to learn, and they may learn very easily, the relations existing between defective drains and waste-pipes and the ill-health of those who live in houses containing them. This knowledge must qualify them to pass a decree of absolute condemnation against every one of these wrongly arranged and badly constructed appliances. Trashy soil-pipes, imperfectly jointed, unventilated, unflushed, and inadequately supported, as they exist in so many of our tenement houses; corroded waste-pipes, half choked with foul accumulations and sagging in their course; traps so shallow, so badly placed, and so badly arranged that they are traps only to catch those who trust them, and open-mouthed sink-wastes, pouring their mephitic exhalations into the interior of close and closely-packed houses,—to say nothing of the worst possible water-closets in the worst possible condition,—these are the rule, not the exception, in nearly all our tenement houses. Even where inspection is rigid, and it is probably nowhere more so than in New York city, the standard by which plumbing is measured is by no means that of the best modern work; it is not even that of the "first-class" houses up-town. It should be, and if tenement houses are to be made fit residences for the poor, the overworked, and the careless, it *must* be something very much higher and better.—*Colonel Waring, in the Plumber.*

A WARNING TO PLUMBERS AND THEIR PATRONS.

Diphtheria, scarlet fever and pneumonia have been particularly active in certain parts of New York and Brooklyn during the past year, and the cause is criminal carelessness, official stupidity, and extraordinary recklessness on the part of property owners, and of builders and plumbers. Although the life of a person in ordinary circumstances is of as much value as the life of a millionaire, it is quite natural that the latter, dying in a costly mansion where money has been lavished on devices for protection and comfort, should attract the greater attention, especially if it were a reasonable inference that sewer-gas was in any degree a predisposing cause. Fortunately the death of the late Mr. Rockwell, in Brooklyn, was brought to notice of the authorities, and the result of an official investigation is most surprising.

When Mr. Rockwell's family began to die, and one after the other was carried to Greenwood, public attention was attracted to the several possible causes of this extraordinary fatality, but no one dreamed that the death-trap was the trap in the millionaire's costly but worse than useless plumbing.

The Sanitary Superintendent of Brooklyn examined the pipes and general plumbing, assisted by an expert. Among other things they found that some of the main lines of soil-pipe that are continued to the roof do double duty—carrying off the sewer-gas and acting as rain leaders. One of the pipes receives the water from 1,200 square feet, and during heavy rains is so filled with water as to empty every trap connected with it. The water-closet in the bath-room was found attached to this pipe, and its trap was so neatly emptied of water that it offered no obstruction to the entrance of sewer-gas. Mr. Rockwell had wash-basins in his sleeping rooms and nursery, but the traps do not hold water, so of course the gas had no difficulty in gaining entrance. In fact, if the builder had desired to turn his house into a hospital and furnish his own patients, he could not have devised a better system of defective plumbing.

SEWER VENTILATION BY FURNACES.—The ventilation of sewers is never perfect till it is constant, and sufficient to prevent all objectionable smells, and all complicated plans for effecting this have proved miserable failures. More than 30 years since it was proposed to connect all sewers with furnaces so as to draw out and consume the foul vapors. The scheme was tried at Battersea, and acted with a vengeance at times, the air being occasionally drawn through the houses, breaking the water seals of the traps, while at intervals the operation was too sluggish to have any good effect. One day some coal gas leaked from the gas to the sewer mains, and the works at Battersea were wrecked. Yet the same idea has been put forward within the past four years as a novel and practicable idea, notwithstanding the literal explosion of the theory in 1844.—*Prof. Corfield.*

SEWAGE UTILIZATION A FAILURE.—From exhaustive articles on utilization of sewerage, in the valuable reports of Massachusetts Board of Health, 1873, 1876, 1877, and also from the report of G. Karwiese, C. E., on the sewerage of Washington, D. C., we must arrive at the conclusions therein determined by statistics, that no process of settling sewerage has proved satisfactory either as a purifier of the affluent, or as a converter of its heavy parts into a profitable fertilizer. In many places where some of the sixty processes for this purpose have been used, there has been no market for the resulting fertilizer. Irrigation seems to be the only way of utilizing sewerage with hopes of a profit, and this plan is almost in its infancy and does not give universal satisfaction.—*Engineer Guthrie, of Buffalo.*

"A Brooklyn plumber was told to carry a 6-inch vent-pipe from a w. c. to the roof. He did so, but was satisfied to insert the lower end in the woodwork below the seat, *without connecting it in any way with either the soil pipe, trap or receiver!* Such an ignoramus should be heavily fined and forbidden to work at the trade until he had served an apprenticeship with some one who knew a little about plumbing."

If we were to reveal some of the imperfect work done by plumbers in the City of Montreal, our citizens would not wonder at its death rate. The above writer calls the Brooklyn plumber an "*ignoramus*," but we suffer from stupidity, ignorance, and wilful negligence all combined. Probably in no City on the continent is so much bad work done by men calling themselves plumbers. It is not from our street drains that our great death rate comes, but from our house drains, which if made perfect in all their joints and properly trapped and ventilated would keep out the poisonous gases bred in the street drains.

—EDITOR *Scientific Canadian.*

REMEDIES FOR CARPET BEETLES, MOTHS, &c.

To the Editor of the Scientific American:

At this season we are frequently besieged by inquiries in relation to the "carpet beetle," moth, etc. Many of your readers may be glad to know of the following simple remedies:

First.—Steep one quarter of a pound of Cayenne pepper in a gallon of water; add two drachms of strychnia powder. Strain and pour this tea into a shallow vessel, such as a large tinned iron milk pan. Before unrolling a new carpet, set the roll on each end alternately in this poisoned tea for ten minutes, or long enough to insure the saturation of its edges for at least an inch. After beating an old carpet, roll and treat all its seams and edges to the same bath. Let the carpet dry thoroughly before tacking it to the floor, in order to avoid the accidental poisoning of the tacker's fingers by the liquid. It is perhaps unnecessary to state that the residue of the liquid should be thrown out where it will not be drunk by any domestic animal, or if preserved for future use, carefully labeled "poison."

This preparation will not stain or disfigure carpets nor corrode metals in contact with the carpet, as will most preparations of corrosive sublimate.

Second.—One pound of quassia chips, one quarter of a pound of Cayenne pepper steeped in two gallons of water. Strain and use as above. This preparation, although irritating to the human skin, especially on cut surfaces, has the advantage of not being poisonous.

To either of these teas from one quarter to one half more boiling water may be added at the time of first using, if greater depth of the liquid in the vessel be required. When it is desirable to treat carpets that are not to be taken up, either of the above preparations may be applied by means of any of the common atomizers to every seam and margin with good results, although a second, and even third, application may be needed.

FRANCIS GREGORY SANBORN,
Consulting Naturalist.

Andover, Mass., April 10, 1879.

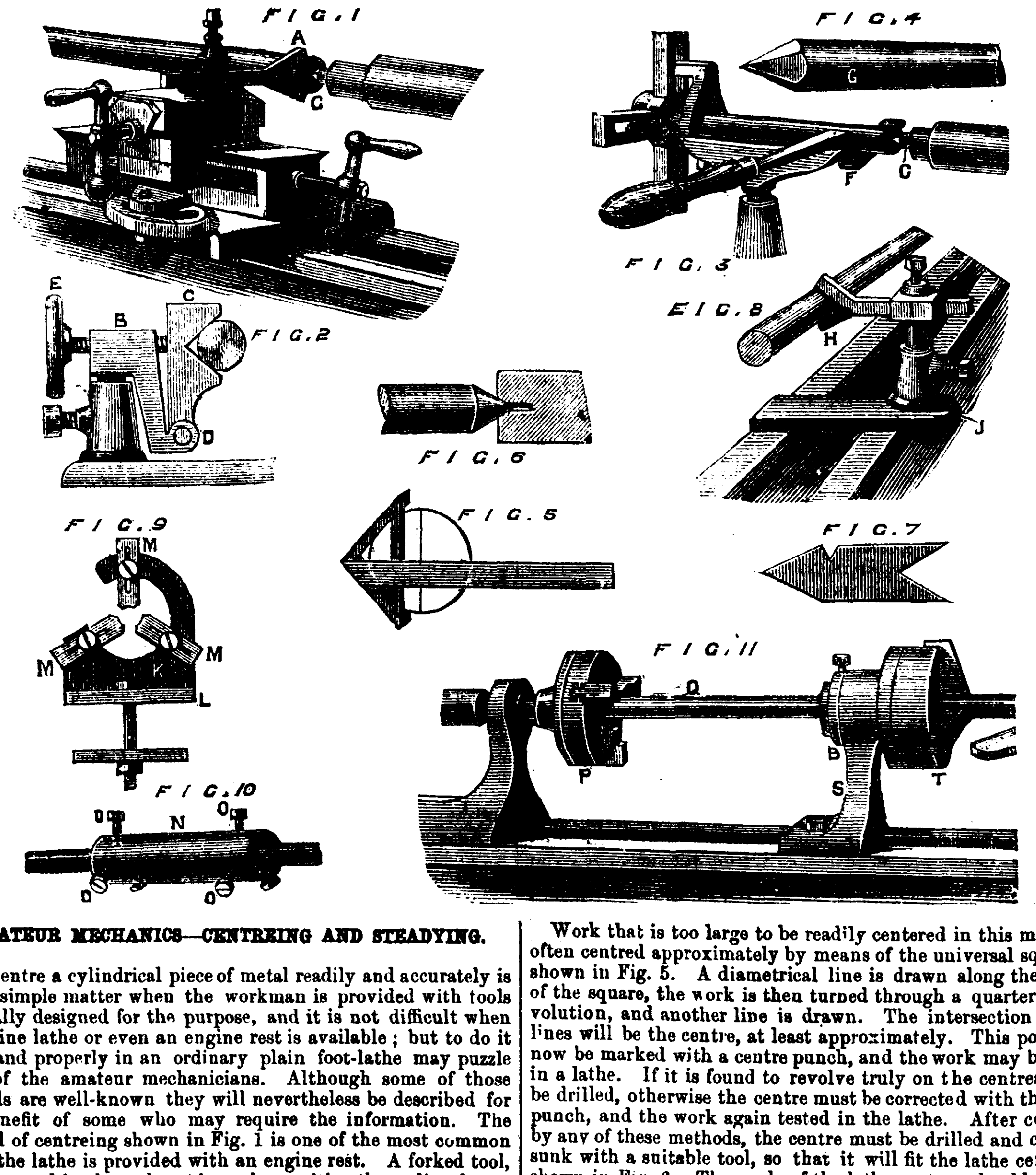
BRITISH vs. AMERICAN TOOLS.

What the English say about American-made tools.

The importation into this country of American-made tools is becoming a somewhat noticeable feature in Transatlantic trade. We have been accustomed for many years past to get our notions from across the water, and very ingenious and very useful many of these little contrivances were. Yankee mousetraps enable our cats to live in dignified idleness. But for Yankee egg-flipper forks would still do duty in this necessary process. Yankee apple-parers and peashellers, carpet sweepers and ash sifters have saved not a little labour, and contributed not a little to our comfort. (The future historian, with characteristic logic, will probably conclude that a nation so addicted to saving labour must have been extremely lazy.) Although, however, the introduction here of most of these and similar articles is due to American enterprise, it is probable that British industry has succeeded in producing them at prices under those at which they can be imported, so that much of the work sold as American is really of British manufacture. And it would appear as though in the future importations from America will become more and more confined to novelties, and continue for given articles only so long as the novelty lasts. In other words, so soon as any considerable demand for a novelty is created here, home manufacturers will supply the demand on terms leaving little scope for importation. In the matter of cutting tools, it is an undoubted fact that American manufactures have gained a very appreciable footing in Russian, Australian, and Canadian markets, hitherto supplied almost wholly by British manufacturers. But, according to the *Engineer*, the late reductions in the prices of English houses have considerably checked the success of American competitions, and there are indications that by the employment of improved machinery foreign enterprise will be yet more effectually met. The *Engineer* proceeds to say:—"An examination of certain tools obtained by a Midland hardware merchant from an American firm, to the order of certain Australian customers, has convinced us that they would have been sent out by no tool-making firm in this country, having other than the very lowest standing; they would most certainly not have been issued by our leading toolmakers. It could hardly have been with goods of this quality that the Americans succeeded in getting the position in the Antipodean markets which led to the preference indicated in the order."

This country may justly be considered the birthplace and home of what are known as machine tools, such as lathes, shaping, drilling, and other machines used in mechanical operations. It is, therefore, somewhat disquieting to find American-made machine tools competing here with tools of home make. Having occasion some time since to buy a number of light machine tools, the writer thought it advisable to carefully examine the American productions of that class, with a view of getting the best tools, whether British or American. The result was not favourable to the American machines. The impression produced by the examination was—first, that the American tools were all too light, much lighter than British tools of same nominal capacity. In a machine tool it is difficult to err on the side of solidity. Mass, indeed, is essential to steady, hard cutting. Secondly, that the workmanship was in no case up to our British standards. It was wanting in that absolute accuracy which characterises the workmanship of our first-rate toolmaking firms. Thirdly, the prices were anything but low. No lower than (if as low as) those of Whitworth, or other firms of the highest standing in this country. The writer concluded that those who required first-rate tools should not go to America for them, whilst those who require cheap tools could procure the cheapest here at home.

American machine tools are not often met with in our engineering workshops proper, but are chiefly found in manufactories devoted to the production of bycicles, sewing machines, and in other such light mechanical industries. Chiefly also in the smaller establishments of this kind. In short, American machine tools are in most favour among those who know least about tools. Amateur mechanics are recommended to think twice before investing in them.



AMATEUR MECHANICS—CENTREING AND STEADYING.

To centre a cylindrical piece of metal readily and accurately is a very simple matter when the workman is provided with tools especially designed for the purpose, and it is not difficult when an engine lathe or even an engine rest is available; but to do it easily and properly in an ordinary plain foot-lathe may puzzle some of the amateur mechanicians. Although some of those methods are well-known they will nevertheless be described for the benefit of some who may require the information. The method of centreing shown in Fig. 1 is one of the most common where the lathe is provided with an engine rest. A forked tool, A, is clamped in the tool post in such a position that a line drawn from the point of the tail centre will bisect the angle of the fork. A square-pointed centre, G, is inserted in the tail spindle and moved against the end of the rod being centered with a slight pressure, the tool, A, being at the same time moved forward by the screw of the engine rest until the rod turns smoothly in the fork and the square-pointed centre has found the centre of the rod; the tail spindle is then moved forward until the cavity is sufficiently deep to permit of starting the centre drill. The angle of square centre, G, for very hard material, should be a little more obtuse than that shown in Fig. 4. In any case, it should be of good material and well tempered.

In Fig. 2 is shown a centreing tool which is designed to take the place of the engine rest and fork in Fig. 1. The part B is fitted in place of the ordinary tool rest, and the jaw, C, which has in it a V-shaped notch, is hinged to the part B at D. A screw, E, passes through the upper end of the part B, and bears against the jaw, C. After what has already been said in connection with the engine rest, the manner of using this contrivance will be readily understood.

In Fig. 3 the hand tool, F, is employed for steadying the shaft and bringing it to a centre. This tool is bent to form a right-angled notch for receiving the shaft, and when in use it is supported by the tool rest after the manner of an ordinary hand turning tool.

Work that is too large to be readily centered in this manner is often centred approximately by means of the universal square, as shown in Fig. 5. A diametrical line is drawn along the tongue of the square, the work is then turned through a quarter of a revolution, and another line is drawn. The intersection of those lines will be the centre, at least approximately. This point may now be marked with a centre punch, and the work may be tested in a lathe. If it is found to revolve truly on the centres it may be drilled, otherwise the centre must be corrected with the centre punch, and the work again tested in the lathe. After centreing by any of these methods, the centre must be drilled and countersunk with a suitable tool, so that it will fit the lathe centre, as shown in Fig. 6. The angle of the lathe centres should be sixty degrees. To insure uniformity in everything pertaining to the centres, the centre gauge, shown in Fig. 7, should be used for getting the required angle on the lathe centres and on the drills used in centreing.

The matter of steadying long, slender rods while being turned in the lathe is often perplexing. In some cases it may be done tolerably well in the manner illustrated in Fig. 8. The fork, H, is supported by the standard, I, which is inserted in the socket of the rest support, J. The device shown, in Fig. 2, may be used in a similar way. Fig. 9 represents a steady rest, the construction of which will hardly need explanation. For light work it may be made of wood; the upright being secured to the cross piece, L, which rests upon the lathe bed. The slotted pieces, M, are adjustable lengthwise to accommodate the size and position of the shaft. When it is required to support a bar which is not round, the sleeve, N, shown in Fig. 10, is employed. It slips over the shaft and revolves in the steady rest. The bar is centered by the screws, O.

The device shown in Fig. 1 is used where a hollow mandrel lathe is not at hand. A piece of gas-pipe, Q, is held by the chuck, P, and is secured by a set screw in the sleeve, B, which is journaled in the standard, S, and carries the chuck, T. The arrangement may also be employed for turning the ends of long rods where it is not desirable to put them regularly on the centres of the lathe.—*Scientific American.*

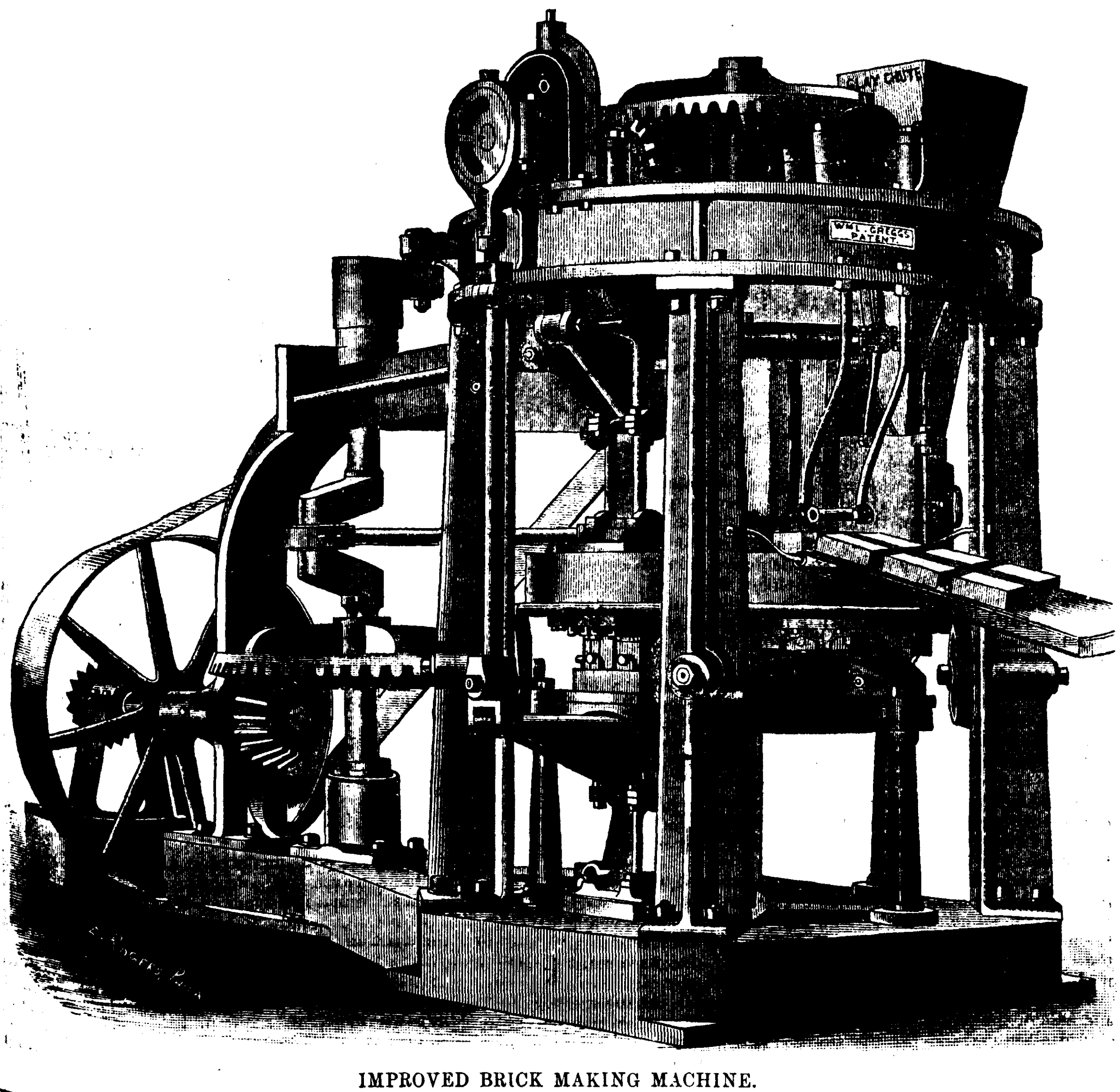
LATEST IMPROVEMENTS IN BRICK MAKING MACHINERY.

Considering the hard and disagreeable labor required to make bricks by hand, and the monotonous motions the brick-maker has continually to go through, it is not surprising that for some years past the minds of inventors have been exerted to contrive machinery by which this could be accomplished by steam-power. The efforts of various inventors have been crowned with more or less success, and several brick machines are now in the market. They, however, labor under the defect that the bricks made by them, after being burned, are not of equal dimensions. The cause of this is to be found in their different densities when the clay leaves the mold, a result of the fact that it was found practically impossible to furnish an equal amount of clay to each of the mold boxes, hence a different amount of compression, of density, and of shrinkage during the baking process. Another defect is coincident, namely, the bricks which have undergone less pressure, and are less dense, are weaker and fragile, lose their edges and corners, become unsuitable for face or front bricks, and therefore greatly reduced in value.

It was the purpose of Mr. Gregg to overcome these difficulties, and the result was the machine which we represent on this page; it molds bricks of uniform size, density, and strength. In order to understand its nature we will speak first of brick machines in general; they may be divided into three classes—dry clay machines, slush machines, and crude or moist clay machines. From the peculiar construction of dry clay machines where "filler boxes" or graduating measures are used to fill the mold boxes, the clay must be dried and granulated to be capable of being filled with any degree of regularity into the "filler boxes," and thence into the molds; and when molds are grouped together it becomes a physical impossibility by the dry clay system to fill them alike, hence those deficient in clay will but partially develop the bricks; this added to the fact of the cohesive quality of the clay being destroyed by extracting the moisture before molding, complete vitrification cannot take place in the burning, and the result is that bricks made from dry clay disintegrate with the action of the elements.

In the manufacture of slush brick the other extreme is met. To facilitate molding in the "hand way" a large proportion of water is added, and the bricks being so soft must be spread upon floors to dry. The slow out-door process of drying, or evaporation, is one of the most favorable processes for the hand brick maker, but it requires the continuous insurance of favorable atmospheric influences and a continuity of fair weather, which practically can never be relied upon. Clay, to be made into bricks by hand molding, must of necessity be so wet that at least 25 per cent of water has to be evaporated before it is safe to burn, so that in fact in works producing 30,000 bricks per day, upward of 23 tons of water have to be evaporated therefrom every 24 hours. The labor attending this is an expensive item, and the bricks are rendered porous by the operation.

Gregg's triple pressure and combination machines occupy a medium position between dry clay and slush machines, and a



IMPROVED BRICK MAKING MACHINE.

first great saving is effected, as the machines accept the crude clay and manufacture it to advantage in so stiff a state as not to contain more than one-eighth of the above amount of water to be evaporated, and yet all of its cohesive qualities are retained.

In regard to the mechanical construction of these machines for moist clay, we must state that the heavy developing pressures take place while the mold table is at rest, thus requiring but a nominal amount of power to operate them, and avoiding strain, wear and tear, and breakage, as well as the great propelling power which is the general concomitant of other machines. When the bricks made of such clay and molded to a great and equal density, are baked, the fusion is more complete, the bond between the clay particles more perfect, the bricks less porous, therefore they absorb less moisture, and are much stronger.

Comparative hydraulic pressure tests have been made between the bricks made by the Gregg machine and hand-made bricks; the result was that while hand-made front bricks were crushed at a pressure of 42,000 pounds, the machine-made front bricks stood 60,000 pounds; when burned hard, the hand-made bricks were crushed at 49,000 pounds, while the machine-made bricks stood 55,000 pounds. When half and quarter bricks were tested the difference was still larger, as the hand-made bricks showed a falling off in strength nearly proportional to their size. This was by no means the case with the machine-made bricks, of which half and even a fourth part were almost as strong as the whole brick. These experiments were verified by direction of the supervising architect of the United States at the Treasury Department, and the result was an order that the Gregg bricks should be used for government work.

This fact, in connection with the highest premiums at all the exhibitions in Europe and in the United States, makes it needless to give here any of the testimonials which are published in the catalogue of the manufacturers, from which we will only extract the result of a tabular caculation of the comparative expense of hand-made brick and that of bricks made by the No. 1 Gregg triple pressure brick machine here represented; it is that the wages of ten molders, ten bearers, ten wheelers, one temperer, and one pitman amount to $252 per week, producing 150,000 bricks; while the expense of one engineer and machine man, one feeder of machine, two off-bearers, one wheeler, expense of coal, oil, and waste amounts at most to $52, also producing 150,000 bricks. Thus we have here a saving of $200 per week, which soon pays for the cost of the machine, while the profit on the bricks is largely increased, the hand-made bricks costing $1.68 per thousand, made ready for burning, and the machine-made bricks 30 cents.

The machine is made by Gregg Brick Co., 402 Walnut street, Philadelphia, Pa., manufacturers and builders.

THE GENESIS OF THE MOSQUITO.

To the Editor of the Scientific American:

For several years past I have noticed in warm weather, that my wooden cistern, which is above ground, has been infested with peculiar looking little red worms. I have heard many others like myself complain of these worms, and I had taken it for granted that they were a species of earth worm. However, last summer I procured a glass jar and sprinkled the bottom of it with a very small quantity of sand and clay. I then half filled the jar with clear fresh water, and, after putting a dozen of these worms in the jar, I tied a piece of cloth over the mouth, and placed it in a light, airy place.

The worms were from half to three fourths of an inch in length, of a bright red color, and had rather a jointed appearance about the body. They would crawl on the bottom of the jar, swim through the water by a rapid bending of the body backward and forward, and occasionally come up to the surface of the water and float.

Within twenty-four hours after placing them in the jar, I noticed that they had all gone down to the bottom of the vessel, and had enveloped themselves separately in a kind of temporary shell made of earth and sand.

In a few days after this I saw one of these worms crawl out of his temporary house at the bottom of the jar, and swim to the surface of the water. Here, after twisting about for a few seconds, he ruptured a thin membrane that enveloped his body, and came out a ful fledged mosquito ready for business. I noticed many of the other worms going through the same performance within a short while afterward. Some of the mosquitoes were much larger than others, but, as I have already stated, some of the worms were also larger than others.

F. W. Coleman, M.D.

Rodney, Miss., April, 1879.

THE FATE OF A HERD OF BUFFALOES.

An army officer who recently arrived in Chicago from the Yellowstone Valley, tells a story of what happened to a herd of buffaloes as they were migrating southward. The herd numbered 2,500 head, and had been driven out of the Milk River country by the Indian hunters belonging to Sitting Bull's band. When they reached the river they ventured upon the ice with their customary confidence, coming upon it with a solid front, and beginning the crossing with closed ranks. The stream at this point was very deep. When the front file, which was stretched out a quarter of a mile in length, had nearly gained the opposite shore, the ice suddenly gave way under them. Some trappers who were eye-witnesses of the scene said it seemed as if a trench had been opened in the ice the whole length of the column. Some four or five hundred animals tumbled into the opening all in a heap. Others fell in on top of them and sank out of sight in a twinkling. By this time the rotten ice was breaking under the still advancing herd. The trappers say that in less than a minute the whole body of buffaloes had been precipitated into the river. They were wedged in so thickly that they could do nothing but struggle for a second and then disappear beneath the cakes of ice of the swift current. Not a beast in all that mighty herd tried to escape, but in a solid phalanx they marched to their fatal bath in the "Big Muddy." In a minute from the time the first ice broke not a buffalo's head or tail was to be seen.

Possibly occurrences of this sort, in ancient tertiary times, helped to form the remarkable deposits of bones found in the old lake beds of the great West and elsewhere. In these deposits the earth is literally crowded with the bones, sometimes chiefly of one type, sometimes comprising many distinct species. In the latter case the victims were probably swept away by sudden floods, their remains mingling confusedly in quiet basins.

NEW PATENT-OFFICE RULE.

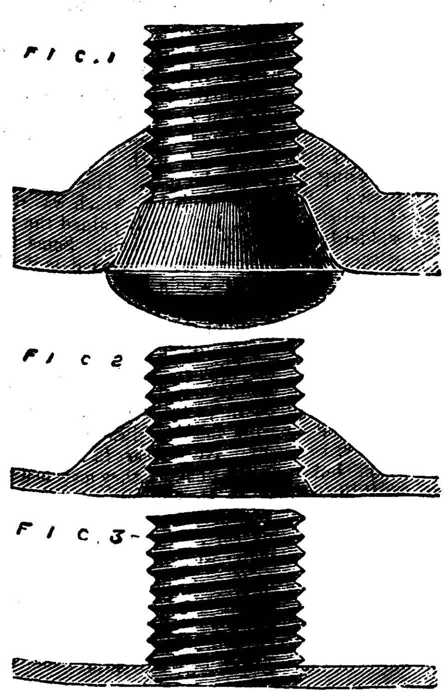
The Commissioner of Patents has issued a rule for correcting errors in letters patent. Its provisions are as follows: Where a mistake, incurred through the fault of the office, is clearly disclosed by the records or files of the office, a certificate, showing the fact and nature of such mistake, signed by the Secretary of the Interior, countersigned by the Commissioner of Patents, and sealed with the seal of the Patent Office, will, at the request of the patentee or his assignee, be indorsed, without charge, upon the letters patent and recorded in the records of patents.

Where a mistake, incurred through the fault of the office, constitutes a sufficient legal ground for a reissue, such reissue will be made, for the correction of such mistake only, without charge of office fees, at the request of the patentee.

Mistakes not incurred through the fault of the office, and not affording legal ground for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent. No changes or corrections will be made in letters patent after the delivery thereof to the patentee or his agent, except as above provided.

Railway Parcel Express Stamps.—A circular has been issued by Mr. A. Atkinson, which states that twenty-five railway companies of England, Scotland, and Wales have resolved that from and after the 1st of January next, they will issue railway stamps of the value of 4d. and 8d., which shall carry parcels of 2 lbs. and 4 lbs. respectively throughout their whole systems, and that they have agreed to accept parcels of these weights and rates throughout the whole of their systems, and to grant an insurance up to 20s. at these rates, thus placing all the stations on these twenty-five companies at the command of the public for the receipt and delivery of parcels not exceeding 4 lbs. in weight.

A Varnish for Replacing Turpentine and Linseed Oil Paints.—Fr. Thies, of Bissendorf, prepares a varnish consisting of 100 parts of colophonium, 20 parts of crystallized carbonate of sodium, and 50 parts of water, by heating these substances together and mixing them with a solution of 24 parts of strong liquor of ammonia in 250 parts of water. With the mass thus obtained, the pigments are levigated without the addition of linseed oil or turpentine; the paint dries readily without the aid of a drier, and looks very well especially when varnished. The paint keeps well even under water and becomes very hard. The cost is said to amount to about one-third of that of ordinary oil paints.—*Deutsche Gewerbe Zeitung.*



STEPHENSON'S EMBOSSED PLATES FOR LOCOMOTIVE FIRE-BOXES.

An improvement in the construction of locomotive fire-boxes has been patented by Mr. J. F. Stephenson, the Assistant-Locomotive Superintendent, Southern Division of the North-Eastern Railway. The invention relates to the staying of fireboxes and the manufacture of plates for the same, the stays retaining ample hold of the plates without renewal until the plates are worm down to the lowest point consistent with safety. The lifetime of fireboxes and furnaces is thus considerably lengthened, thereby effecting great economy in maintenance and removing a source of anxiety to locomotive engineers. The improvement is accomplished at a very slight additional cost, as will be seen by the accompanying diagrams.

The plates of a boiler exposed to the action of fire, particularly those which form the sides of the firebox, are usually supported by staybolts passed or screwed through them and secured to the outer shell or to other plates separated from the former by a water or steam space. As the plate and the head of the staybolt become corroded, scaled, or burnt the hold of the stay on the plate and the plate itself are so much weakened that the latter frequently gives way, and serious accidents sometimes occur from this cause. The object of the invention is to strengthen such plates in the parts through which the staybolts pass, to give the staybolts a better hold therein, and to protect the stays as well as the strengthened portions of the plates from the destructive action of the heat. For this purpose those parts of the plates through which staybolts are to pass are subjected to a squeezing action produced either by pressure or blows between blunt punches and hollow dies so that the metal of the plate is at each stay place hollowed in on the one side and made to project as a boss on the other side. In some cases the stay bosses produced as above described are subjected to a further squeezing between punches and dies, so as to thin the middle of the boss and swell it out laterally. The embossing may obviously be effected by passing the plates between rollers having suitable hollows and projections; also, when the metal will permit, the required bosses may be formed by casting them on the plates, soldering or welding them thereon. Through each boss a hole is made and a screw-thread cut in it for the reception of the staybolt, the head of which appears on the side of the plate that is to be exposed to the action of the heat, whilst its screw-thread extends throughout the whole depth of the boss that projects on the other side. The hole in the boss may be countersunk to receive the partly-coned head of the staybolt, which can thus be partly sunk into the body of the embossed plate. Plates thus prepared and stayed may be much thinned down by the action of the heat, and the heads of the staybolts quite burnt away, and yet the stays retain a good hold by the depth of screw-thread still remaining in the bosses which project on the side of the plate that is not exposed to the destructive action. Fig. 1 represents a section of the embossed plate at a staybolt; Fig. 2 represents the same when worn out; and Fig. 3 represents the ordinary staybolt and plate when worn out.

Watchmakers' and Jewellers' Work.

CHARCOAL ASSAY.—By this process an assay accurate enough for small quantities, can be made in a short time. Suppose you have melted and refined some gold filings, you now have the gold and silver, and wish to know the carat. Try it on the "touch-stone" and approximate its quality. Weigh *very* carefully 12 grains; reduce this by means of fine silver to 8 k., or a little less; melt this into a shot and flatten on a clean piece of steel, then anneal and roll into a thin ribbon, coil it loosely like a watch spring, then anneal and put in a glass retort; cover with nitric acid one-half, water one-half; boil for 10 minutes, then pour off the solution again, rinse well and then boil for five minutes in pure nitric acid; rinse several times with hot water. Dry the gold and melt it into a shot, then weigh this shot. Twice the weight will be the carat of the metal. It is unnecessary to say that the utmost care must be taken as to weight and the manipulations to succeed in arriving at accurate results by this process.

TOUCH STONE.—Obtain a piece of silica or "black stone," as it is called, from the lapidary and have it made smooth on one side. Solder on the ends of brass wire a small piece of 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, k. gold. You may not need all of these, 10, 12, 14, 16, 18, 20, 22 k. will answer. Be sure that these pieces are alloyed correctly. Take the gold you wish to test, rub it on the stone, the same as you would rub a pencil on paper, it will leave a streak. Now after forming something of an estimate by its looks, as to its quality, (suppose you think it 14 k.) rub point 16 k. on one side and 12 k. on the other, and place the acid on each streak the same instant. If the 12 k. streak disappears first, the object streak next, and 15 k. last, you may infer that the gold is better than 12 k. and poorer than 16 k. Try again with 13 k. and 15 k. and judge as before.

TO REMOVE THE DEVIL OR TIN FROM THE STOCK.—Just before pouring the gold throw a small piece of corrosive sublimate in the pot, stir well with a long piece of pointed charcoal, and allow the pot to remain on the fire about half a minute afterward. This will take tin from the alloy; while the tin is in, the gold *will not roll* without cracking. To remove emery or steel filings, &c., from gold, when melting, use a small piece of glass-gall, it will collect them in the flux.

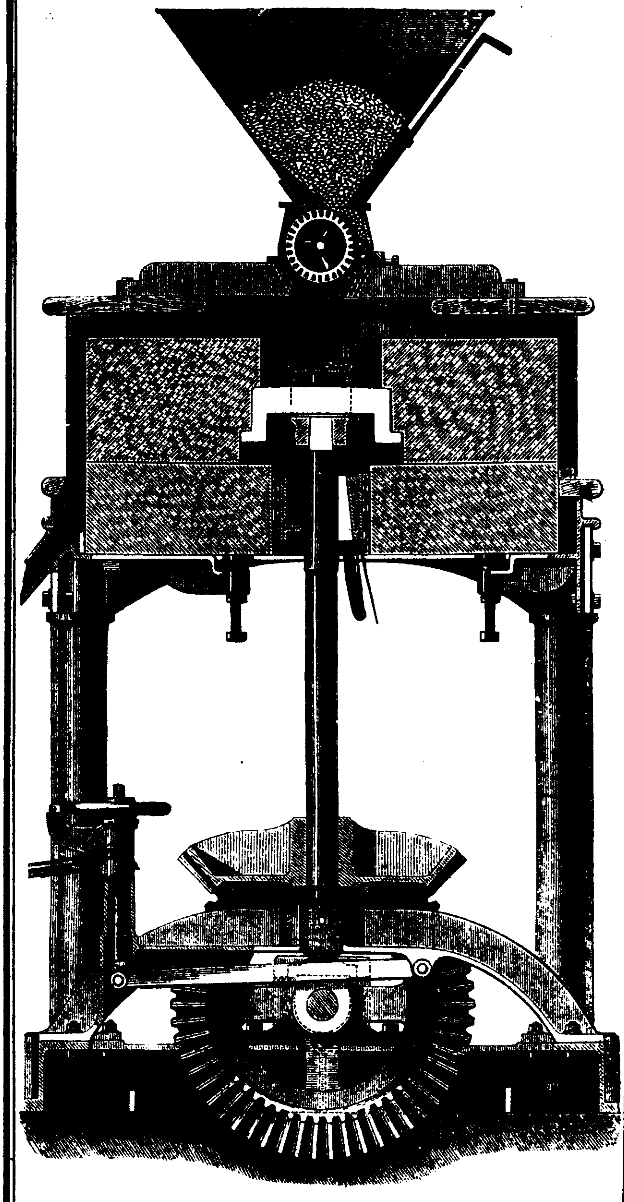
TO TEMPER BRASS, OR TO DRAW ITS TEMPER.—Brass is rendered hard by hammering or rolling; therefore, when you make a thing of brass necessary to be in temper, you must prepare the material before shaping the article. Temper may be drawn from brass by heating it to a cherry red, and then simply plunging it into water, the same as though you were going to temper steel.

TO TEMPER STAFFS, CYLINDERS, OR PINIONS, WITHOUT SPRINGING THEM.—Prepare the articles as in the preceding process, using a steel plug. Having heated the key-pipe to a cherry red, plunge it into water; then polish the end of your steel plug, place the key upon a plate of brass or copper, and hold it over your lamp with the blaze immediately under the pipe till the polished part becomes blue. Let cool gradually, then polish again. Blue and cool a second time, and the work will be done.

TESTING.—The acid to be used is nitric, slightly diluted, with the addition of a small quantity of salt. You should have two or three bottles containing fluid of different strength; for 22 to 18, use the above; for lesser grades dilute with more water. After a little practice a good observer can arrive within half a carat of the quality.

TO REMOVE QUICKSILVER FROM RINGS, CHAINS, &c.—Sometimes quicksilver will get on a piece of work and completely cover it. This makes the article very brittle, as well as spoiling its appearance. Heat the article gradually and under the spot where quicksilver is on—avoid the flume. It will entirely remove it.

TO TIGHTEN A RUBY PIN.—Set the ruby pin in asphaltum varnish. It will become hard in a few minutes, and be much firmer and better than gum shellac, as generally used.



MILL FOR GRINDING MAIZE.

In the usual operation of grinding maize, the stones have to be set so far apart that the meal is not delivered of sufficient fineness for human food at one operation, and therefore a double grinding is required.

In a mill constructed by Messrs. Ransomes, Sims, and Head, of Ipswich, as shown in the engraving, the maize is first cracked quite fine by the corn cracker which is placed over the mill, and therefore when it enters into the mill, being in pieces about the size of an ordinary kernel of wheat, the stones can be suitably dressed and set sufficiently close for producing meal for household purposes at one operation. The barrel of the corn cracker is hollow, and is formed by a number of separate triangular steel cutters arranged round the circumference of two end rings, and so they can never choke; each tooth having three edges they can easily be successively used. The corn is cracked or cut between the edges of these teeth and a cutting plate, the edge of which is adjusted by a screw until it is sufficiently close to produce the required degree of fineness in the maize.

These mills have been largely used and are very economical in their operation. They will grind wheat equally as well as maize; they are specially adapted for those districts where the food of the country consists of both maize and wheat.—*Engineering*.

AN IMPROVEMENT IN SHIFTING CARRIAGE TOPS.

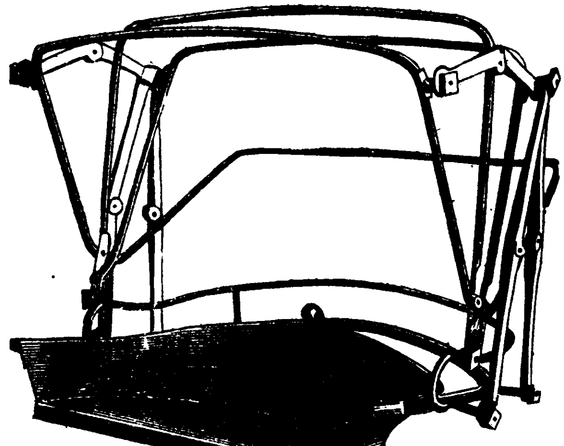
The accompanying illustration represents a new invention lately patented by Messrs. Gillespie & True, of Laclede, Missouri.

It relates to certain improvements in shifting tops for carriages, buggies, &c.; and it consists in a horizontal bottom rail, to which the top frame is attached, which said rail is slid into grooves, around the top edge of the seat and held therein by a locking-key. It also consists in a double set of vertical supporting-props for the top, whereby the latter is more securely held in an elevated position.

Around the top edge of the buggy seat is formed, by horizontal flanges, a groove. The frame of the buggy top is constructed upon, and attached to, a bottom rail, which slides into the groove of the seat. Said rail is made preferably square, but may be of any other shape, and is slided from the rear of the buggy into its groove. A spring-locking key passes through two extensions of flanges of the buggy seat, and locks the horizontal rail securely in its position in the groove, the ends of said rail being firmly secured in sockets. In order to give greater rigidity to the top and prevent its falling from the wind or accidental contact with trees, the inventors construct upon the bottom rail two knuckle-jointed props, instead of one, each bending in an opposite direction from the other, so that the top is braced in both directions in the most thorough and substantial manner.

The advantages claimed for this shifting top are, ease of construction, convenience of adjustment, and general adaptation to buggies already in use, with but little alteration.

To remove the top, all that is necessary is to take out the locking-key and slide the top to rear, so as to withdraw the rail from the groove, thus affording a much more convenient adjustment than the old form of unscrewing the top.



SHIFTING CARRIAGE TOP.

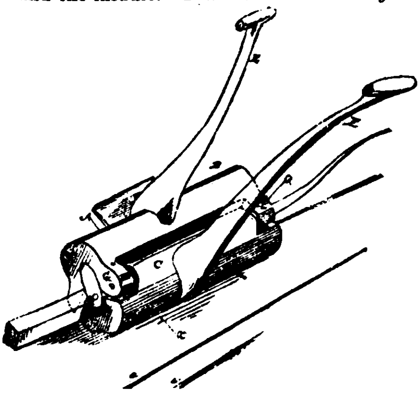
IMPROVED ROOFING TONGS.

Our illustration represents an improvement in roofing tongs, recently patented by Thomas Beeson, of Wilmington, Del. It is claimed for these tongs that they are unusually easy to work with, and that they hook and close sheets securely without the use of the mallet.

The construction is quite simple, and readily understood by any mechanic at a glance. The lower jaw, X, is V-shaped where it bears against the edge of the sheet, and the upper is pivoted with it on the line G G, and carries a journaled roller, which slides down over the V when actuated by the handles E E, carrying the sheet tin down with it to an acute angle. By reversing the position of the jaws, end for end, and closing them again, the sheet is laid home and the job done without a touch of the mallet.

The roller being free to turn, relieves the metal from much of the friction, and makes the operation of the tongs easier and smoother. One of the handles is furnished with a foot-piece at A, to give additional power when required.

There is no lost motion in the jaws; and it is impossible to make "spews" in making grooves when the jaws bite the same at the ends and the middle.—*Plumber and Sanitary Engineer.*



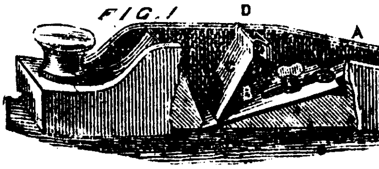
IMPROVED ROOFING TONGS.

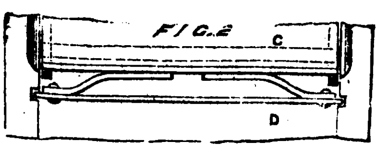
NEW VARNISH FOR FOUNDRY PATTERNS.—A varnish for foundry patterns and machinery has been patented in Germany, which dries as soon as put on, gives the patterns a smooth surface, thus insuring an easy slip out of the mold, and prevents the patterns from warping, shrinking or swelling, as it is perfectly impervious to moisture. This varnish is prepared as follows: Place in a vessel 50 pounds of shellac, 10 pounds of manilla copal, and 10 pounds of Zanguebar copal, and heat it by the external application of steam for four or six hours, stirring it in the meantime constantly. Then add 150 parts of the finest potato spirit, and heat the whole during four hours to 190 deg. Fah. This liquid is then dyed by the addition of orange color, and can be used for painting the patterns. When used for painting and glazing machinery, the varnish may consist of 35 pounds of shellac, five pounds of cocoriel copal, 10 pounds of Zanguebar copal, and 150 pounds of spirit. Similar varnish to the above is used quite extensively by pattern-makers in this country, and much of the superior appearance of American castings is due to its use.

IMPROVEMENTS IN PLANES.

The accompanying engravings represent an improved bench plane, recently patented by Mr. Patrick Gallagher, of Eureka, Nevada. In Fig. 1 the side of the plane is broken away to show the internal construction, and Fig. 2 is a detail view of the cap supporting device. The improvement is applicable to either a jack plane, fore plane, or jointer, of wood or iron. The iron or bit, B, is screwed by a clamp screw in the body of the plane, A, forming a small angle with the bottom of the plane, and it is held in position near its cutting edge by the cap, C, which is pivoted on a pin that runs transversely through the plane. The position of the cap above its pivot is pressed forward by two strong springs that are supported by a cross bar, D, fitted to slots in the sides of the plane. These springs keep the cover down on the lower end of the bit or iron, holding it firmly in place. As the cutting iron lies more nearly flat than in ordinary planes it will make a smoother surface, and it is more easily adjusted than irons fastened with a wedge in the usual way.

FIG. 1





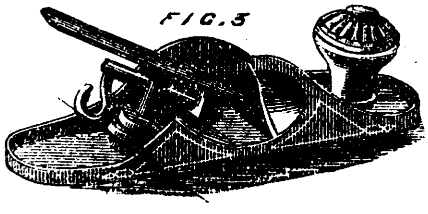
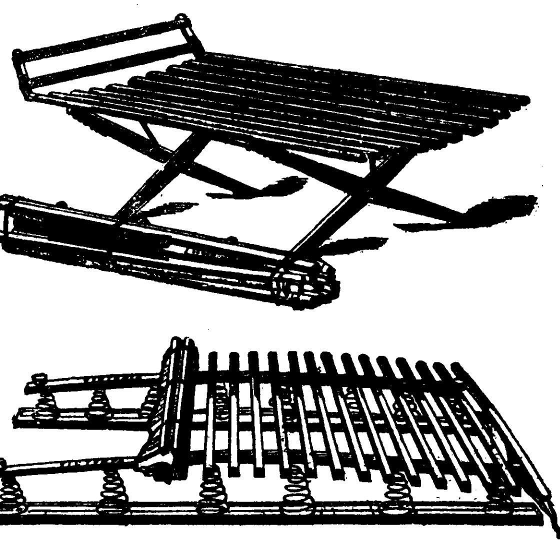
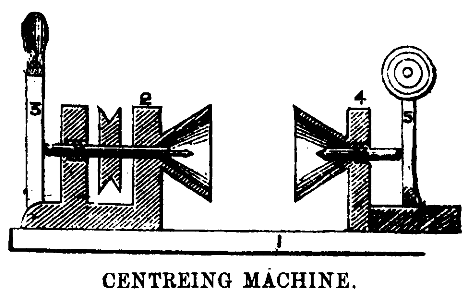


Fig. 3 shows a new adjusting device for plane bits or irons, recently patented by Mr. L. Baily, of Hartford, Conn. It is especially designed for metallic planes, and consists in a stud which supports the bit, and is adjustable in a socket that is cast with the body of the plane. A differential screw passes through this stud, and engages a nut having a pin or stud projecting from one of its sides, which may be inserted in any of the several holes in the bit. The differential screw has a jointed handle which answers the purpose of a lever, by means of which the bit may be nicely adjusted.—*Scientific American.*



"VICTORIA" PATENT SPRING BED BOTTOM.

The Victoria Manufacturing Company, Wolverhampton, are now sending out a new patent spring bed bottom, the principle of which is shown in the accompanying illustrations. It is constructed of light and fragile-looking wood laths and stretch bars upon steel coil springs, which latter suffice to impart an easy and comfortable elasticity to the bed, so essential to rest and repose. The main features of the invention are its extreme portability, cleanliness, and cheapness, and its equal adaptability to iron as to wooden bedsteads.



CENTREING MACHINE.

(SEE PAGE 180.)

CENTERING MACHINE.

A writer to the *English Mechanic* on the above subject says :—Many amateurs find a difficulty in centering their work truly for the lathe, and various devices have been designed to overcome this difficulty. One consisted of a kind of box, with conical recess, which is placed over the end of the bar to be centred, and a centre punch is driven down through the handle ; but if this centering cone is held a little on one side, instead of the dent being in the centre, it is eccentric. I have designed two or three machines intended to overcome this difficulty. The following consists of a bed or plate, 1, which may be of a suitable length, and placed either vertical or horizontal. There are two kinds of poppits shown, each having a hollow cone. The one shown at 2 has a mandrel like a lathe, being kept to the left by a spring. One end carries a drill, or hollow cutting cone, for pointing small bars, to be used with a hollow centre chuck. The handle, 3, is to feed the drill in its work. The poppit, 4, has a centre punch, which is also kept back by a spring. The handle, 5, is forced against the end of the punch by a spring behind it. To use it, pull back the ball at the end of the handle as far as it will go, and let it spring back against the end of the punch.

THE COMPOSITION AND WORKING OF ALLOYS.

Bronze Alloys.

A bronze in imitation of gold may be made of 45·5 parts copper, 3·5 parts tin and 1 part zinc—50 parts. Bronze medals are generally cast of an alloy of 50 parts copper and 2·8 parts tin. This alloy is very hard. A softer bronze for medals than the above is composed of 46 parts copper and 4 parts tin. Ancient bronze nails were made of 40 parts copper to 1 part tin, and were very flexible. Soft bronze is composed of 18lb. copper to 2lb. tin. Hard bronze is composed of 20lb. copper to 5lb. tin. The ancient bronze mirrors are said to have contained 16 parts copper to from 7 to 8 parts tin. At the time of Louis XIV. of France, a period when the art of casting statues was much cultivated in France, statues were cast of an alloy of 30·6 parts copper, 0·11 parts tin, 2 parts zinc, and 0·6 parts lead. The statue of Louis XV. is cast of 82·4 parts copper, 10·3 parts zinc, 4 parts tin, and 3·2 parts lead. The bronze of the ancient Greeks consisted chiefly of copper and tin, but was frequently alloyed with arsenic, zinc, gold, silver, and lead. All their shields and weapons of war were made of bronze, as well as coin, nails, kitchen ustensils, &c. All the ancient nations seem to have understood the art of tempering bronze and copper, and the ancient Mexicans understood the art of converting bronze into edged instruments in a high degree, but the art of tempering and hardening bronze and copper has been lost to modern nations; but as we understand the working of iron better than the ancients, and have steel, an alloy of iron and carbon, which the ancients did not have, we do not miss this art much.

Bell-metal Alloys.

One hundred and forty-four pounds copper, 53lb. tin, and 3lb. iron, are said to make a superior bell. Iron, copper and tin do not unite well, if each is added separately to the other. but if tin-plate scraps are melted in a crucible together with tin, and then this tin and iron alloy added to the molten copper, it will unite readily. Another alloy that is highly recommended is composed of 53·5 parts copper, 6·11 parts iron, 2·13 parts lead, and 3·9 parts tin. This alloy has a good, sonorous sound, even if the mould is not thoroughly dry. House bells are made of 4lb. tin to 16lb. copper. Soft musical bells are made of 3lb. tin to 16lb. copper. Common bell-metal consists of 50lb. copper to 15 or 20lb. tin. The silver bells of Rouen, France, consist of 40lb. copper, 5lb. tin, 3lb. zinc, and 2lb. lead. Too much tin causes bell-metal to be brittle. The gongs or cymbals and tam-tams of the Chinese are composed of 40lb. copper to 10lb. tin. To give these musical instruments their proper tone, they are plunged in cold water while hot, after being cast; cooling in water deprives the metal of almost all its sound. It is tempered and very slowly cooled, which imparts to it peculiarly powerful sound. If bell-metal is suddenly cooled, it becomes less dense and hard, and is increased in malleability, but the tone of the metal is decidedly impaired, and bells ought never to be cast in damp moulds. When bells are cooled suddenly they should be reheated and tempered by cooling slowly.

Type Metal.

Six parts lead and 2 parts antimony form a very hard and brittle alloy used for small type. Eight parts lead and two parts antimony form a softer alloy that is used for larger type. Ten parts lead and two parts antimony form an alloy that is still softer, and is used for medium-sized type. Fourteen parts lead and 2 parts antimony form an alloy that is softer than any of the above alloys, and is used for the largest-sized type. A small amount of tin is sometimes added to the above mixtures, and some typefounders add 1 or 2 per cent of copper. Both of these metals improve the quality of the type, when used in small quantities. Forty parts lead, 8 parts antimony, and 2 parts tin form an alloy that is used for stereotype plates. Six parts lead and 2 parts tin form a coarse solder, used by plumbers. This alloy melts at about 500° Fah. Two parts lead and 4 parts tin form the fine solder used by tinners. It melts at about 358° Fah.

Lead Alloys.

Ninety-four parts lead and 6 parts antimony form an alloy that may be rolled into sheets, and is a little harder than pure lead. This alloy is much used for sheathing for ships. Twenty-four parts lead and 4 parts antimony form an alloy that is used in place of Babbitt metal for filling small boxes and bearings. Twenty parts lead and 4 parts antimony form an alloy that is a little softer than the above, and is used for the same purpose. Either of these may be hardened by the addition of more antimony ; but care must be taken not to use too much antimony, for it will cause the alloy to lose its fluidity, and it cannot be run into the boxes. All alloys of lead and antimony are rendered more fluid by melting them under a covering of oil. Five parts lead and 5 parts tin make a beautiful white alloy, used for organ pipes. The mottled or crystalline appearance, so much admired in the pipe, is caused by using an abundance of tin. One hundred parts lead and 2 parts arsenic form an alloy from which drop shot is made. Eighteen parts lead, 4 parts antimony, and 1 part bismuth form an alloy that expands on cooling. This alloy is much used for metallic patterns for snap mouldings.

Spelter-solder Alloys.

A good solder for copper and iron is composed of 3 parts zinc and 4 parts copper. A softer solder that is used for ordinary brass-work is composed of equal parts of zinc and copper. A very hard but fusible solder is composed of 2 parts zinc and 1 part copper. This solder is so hard and brittle that it can be easily crumbled in a mortar when cold. The two first solders are first alloyed and cast into ingots. The ingots are allowed to cool in the mould and then reheated nearly to redness upon a charcoal fire, and are broken up on the anvil, or in a mortar, into a finely granulated state, for use.

Hard-solder Alloys.

The following metals and alloys are usually used as solder in the art of hard soldering :—Fine or pure gold rolled or beaten into sheets, and into shreds or small pieces, is used as the solder for soldering chemical vessels made of platinum. Silver solder is composed of 4 parts silver and 2 parts yellow brass. Yellow brass is much used for hard soldering. The brass is used in this solder, so that the operator can tell when the solder is fused by seeing the blue blaze caused by the burning of the zinc. This solder is either rolled into thin sheets and cut into small bits for use, or is granulated while hot. The gold solder, the composition of which is given under the head of gold alloys, is rolled into thin sheets and used for soldering gold alloys. Gold soldering is generally done with the blowpipe, as the work is seldom large enough to require the brazier's hearth. Pure copper, in shreds, is sometimes used for soldering iron. Spelter solders, granulated while hot, are used for soldering iron, copper, brass, gun metal, German silver, and sometimes for gold and silver alloys. As a cheap substitute for silver solder the white or button solders are commonly employed for the white alloys, such as German silver, gun metal, &c. The flux most generally used in hard soldering is borax. In fact there is very little hard soldering done without the aid of this flux. It is generally granulated, and used in the dry state for large or heavy work, and for small work it is generally used in solution with water.

Soft-solder Alloys.

The soft solder used by plumbers, called sealed solder, is composed of 2 parts tin and 4 parts lead. This solder melts at 450° Fah. The common solder used by tinsmiths is composed of 4 parts tin and 2 parts lead. This solder melts at 350° Fah. The bismuth solder is composed of 7 parts bismuth, 5 parts lead, and 3 parts tin. This solder melts at about 225° Fah. All the tin and lead solders become more fusible the more tin they contain. Thus 1 part tin and 10 parts lead melt at about 550° Fah. ; while 6 parts tin and 1 part lead melt at about 375° Fah. ; and all the tin, lead, and bismuth solders become more fusible the more lead and bismuth they contain. The fluxes used in soft soldering are borax, sal-ammonia, chloride of zinc, common resin, Venice turpentine, tallow, and sweet oil. Those most commonly used for ordinary work are common resin and chloride of zinc.

Babbitt Anti-friction Metal.

The metal is made of 1 part copper, 3 parts tin, 2 parts antimony, and 3 parts more tin are added after the composition is in the molten state. This composition is called hardening, and when the metal is used for filling boxes, 2 parts tin are used to 1 of hardening. The above alloy constitutes the best anti-attrition metal in use, but on account of its expense it is very little used. The anti-attrition metals commonly used are principally composed of lead, antimony, and a little tin, but they are not nearly so good as the above.

GRINDING TWIST DRILLS.

(*See page 182*)

What is described as a "simple, cheap, and efficient" means for grinding or sharpening twist or other drills, has been patented by Mr. A. K. Rider, of Walden, New York. The object of the invention is to ensure the most perfect form of cutting edge without the employment of skilled labour. The invention consists first in a device composed of a stock, A, for supporting the drill, consisting of grinding perforated face, B, provided with a grooved shank, C, angularly disposed in relation to the perforated face, B, and means for holding the drill within the groove formed in the shank, whereby the body of the drill may be firmly secured to the shank, and the cutting end of the drill caused to extend any desired length through the face, B, of the stock, and thus allow of the ready and accurate grinding of the drill. The invention further consists in a means for securing a drill within said shank in such a manner that the drill shall be prevented from any lateral movement, while it will admit of a predetermined axial movement in order that the edges or lips of the drill may be ground in an equal degree, and always at the same relative angle to each other.

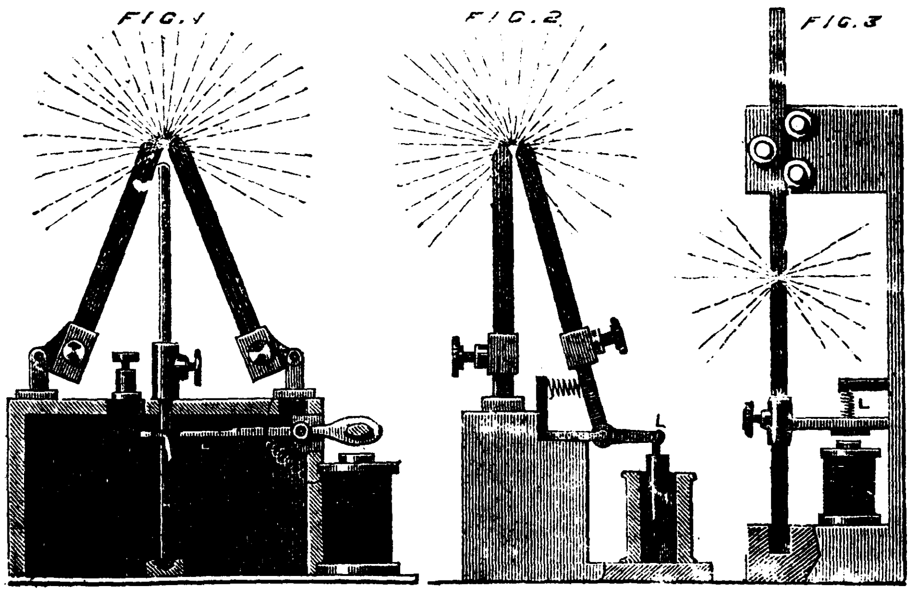
A perforated grinding plate or face is also provided with a grooved shank, angularly disposed to perforated face, a clamp, G, for securing the drill firmly within the grooved shank, and a collet, H, adapted to be removably secured to the drill and also to the shank, whereby the drill may be adjustably secured within collet, H, and the latter adjustably locked to the shank. Fig. 1 is a plan view of the improvement; Fig. 2 is a side elevation of the same, and Fig. 3 is a side elevation of the tool for grinding tapered shank drills. The stock is formed of the grinding face, B, and a shank, C, which parts may be cast or forged solid in one piece, or may be made separate, and secured to each other at their points of juncture, either in a rigid or in an adjustable manner. The shank, C, is provided with a groove, preferably of V-shape, which extends throughout its length and merges into the diamond or other shaped opening, E, formed in the face, B. Opening E extends completely through face, B, and is gradually contracted in size from the upper to the lower surface of the face. The V-shaped groove formed in the shank, and the diamond-shaped opening in the face, together constitute a continuous V-shaped groove for supporting different sized drills. Shank C, about midway between its length, is provided with a through slot or opening, within which is placed the head of a clamp, G, while its screw-threaded shank or stem projects through or beyond the lower surface of the shank to allow of the attachment of a suitable washer and nut. Clamp G consists of a perforated head upon the upper portion of which is formed an elongated bearing surface, which is of sufficient length to overlap one of the spiral cuts or grooves of the drill to be ground or sharpened, and thus operate to secure the drill firmly in place and prevent any tendency of the drill to revolve. The eye of clamp, G, is of sufficient size to admit the largest size drill, and it is obvious that the smaller sized drills can be firmly secured by the single clamp owing to the fact that it is adapted to be adjusted at right angles to the drill. In the present instance the eye is circular, but it is evident that it may be of diamond or any other desired shape. H represents a collet. In the present instance it is shown as being made of a single piece and split on one side through ears or lugs, each of which has a thumbscrew, J, as the drill requires to be held firmly against axial movement in order that the cutting lips may be ground or sharpened in an accurate manner. A collet is provided for each size of drill. When the screw, J, is outwardly turned the ears separate sufficiently to allow of the adjustment of the drill within the collet, and by tightening the thumbscrew the drill is securely held in place. Collet H is provided with two rectangular projections formed on one end thereof, and located diametrically opposite each other. The end of the shank is provided with a corresponding rectangular recess within which one of the projections of the collet is received when the device is to be used. The collet serves to admit of the reversal of the drill just one-half of a circle or revolution, and prevent the endwise movement of the drill in order that the opposite lips or cutting edges of a drill may be subjected to the same grinding action, and the same angle of each lip or cutting edge always secured.

It will be observed that the collet is adapted and arranged to have a movement at right angles to the shank in order that different size drills may be firmly seated within the groove, but the endwise or axial movement of the drill when the latter is being sharpened or ground, is effectually prevented by the collet. The operation of the improved device is as follows:—The drill to be ground or sharpened is inserted in the V-shaped groove, and through the eye of the clamp, Fig. 2, the cutting end caused to project the desired distance below the lower surface of the face or plate, B. The cutting angle of the entering edge made more or less acute according to the relative radical position of the edge or lip of the drill relative to the plane of face, B, should the lip coincide with the bottom of the groove a cutting edge of 90° would be formed, and if placed at right angles to this plane it would result in securing the most acute cutting angle the device is capable of procuring. It is, therefore, easy to impart any desired angle to the cutting edges, as this matter depends solely on the relative radical position of the edge of the drill to the plane of the face.

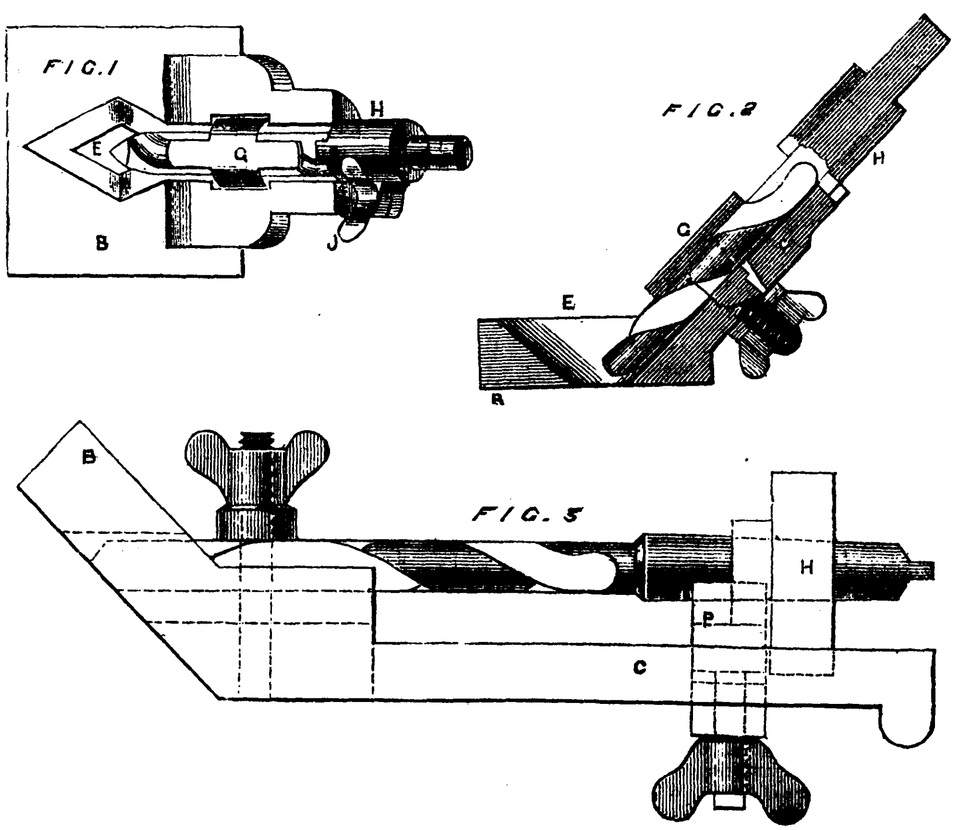
The amount to be ground off and the angle of cutting edge being determined, the drill is securely fastened in its proper position by means of the clamp, the nut of which is turned down snugly against the washer or surface of the shank. The collet is then slid over the drill and one of its projections entered into the rectangular recess in the end of the shank, when the thumbscrew is turned down, and the collet thus firmly secured to the drill, preventing an axial movement of the same. The face, B, is then applied to an ordinary grindstone, and the projecting end of the drill is ground off plane with the under surface of face. The clamp is then released sufficiently to allow the collet and drill to be withdrawn to release the projection from the recess in the shank, when the collet is given a half revolution and the opposite projection is entered into the recess. The clamp is then secured in place, and the opposite side of the drill is then ground off to a plane with face, B. This operation causes the cutting edges of the drill to be ground to identically the same form, angle, and length, and gives the advantage of a straight entering edge, which causes the drill to enter easily, particularly at its centre or neutral axis. The groove is usually made V-shaped for receiving the drill, and extends the whole length of the shank, C, while in other cases, as represented in Fig. 3, for grinding tapered shank drills, only a portion of the shank is provided with the V-groove. The shank, C, in this case is provided with a slot in which the stopper, P, moves for regulating the axial or longitudinal movement of the drill by engaging with the collet, H. The clamp, G, in this case for holding the drill to the stock, is acted on by a thumbscrew from the top of the tool, as represented in Fig. 3. If it is desired to grind or sharpen ordinary drills the collet may be dispensed with, and the shank lengthened out to afford the necessary support for the end of the drill. The device may also be used to grind up end drills, in which case the shank is set at nearly right angles with the face.

A CHANCE FOR INVENTORS.

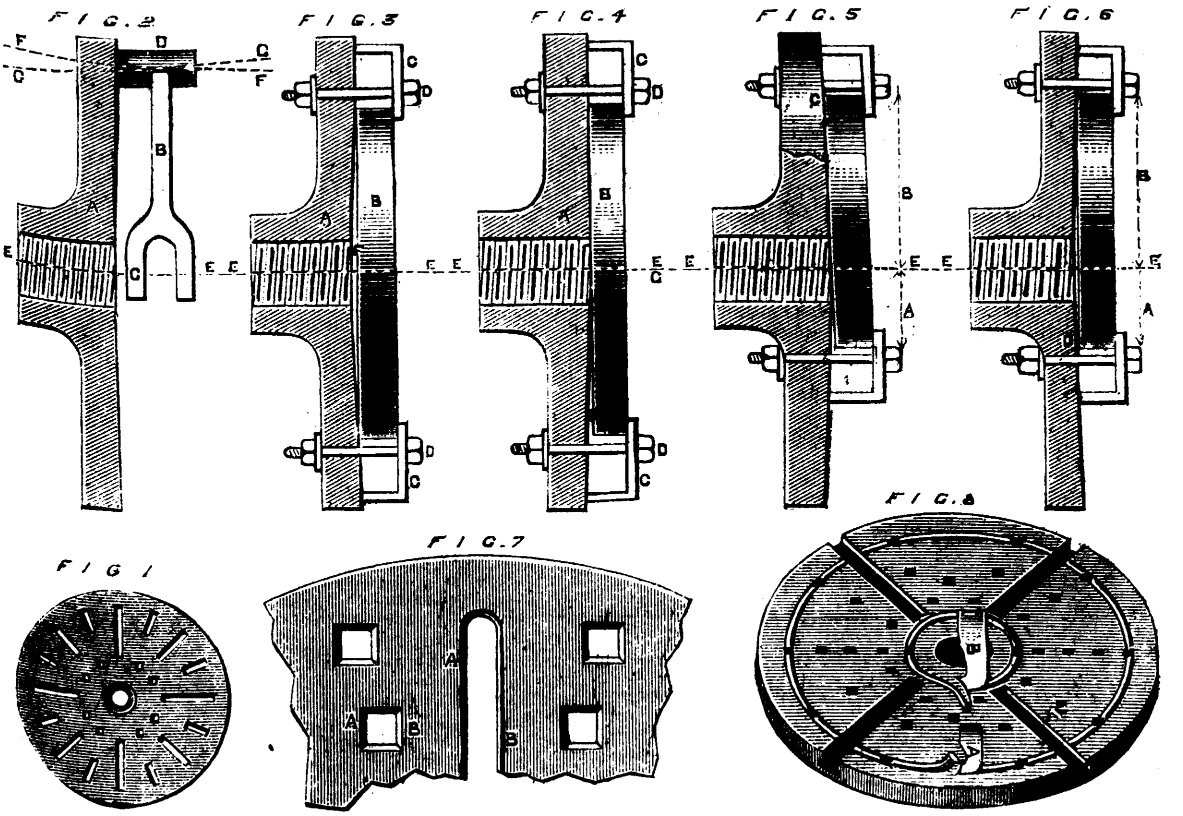
The Secretary of the Treasury has constituted a board, consisting of Captain Forbes, manager of the Massachusetts Humane Society, Captain Moore and Lieut. Sparrow, of the Revenue Marine Service; together with Mr. B. C. Sparrow and Captain Patterson, of the Life Saving Service, to investigate all plans, devices, and inventions for the improvement of apparatus for use at life saving stations, which may appear meritorious and available, and to examine and test as far as practicable all such as may be submitted by the general superintendent, and to make detailed reports of the results of the investigations and tests for his information. The scope of the board embraces action upon all devices for the improvement of life saving apparatus intended to be used at the life saving stations, except wreck ordnance and its immediate appurtenances, which will be referred to a board composed of experts in gunnery, and two practical surfmen to give them aid upon points connected with the actual wreck service. Devices intended to be carried on board ship do not fall within the scope of the action of the board, as this class of life saving apparatus is taken cognizance of by the steamboat inspector's service. Capt. Forbes has been designated president, and has been directed to call a meeting of the board as early as practicable, as there are already on hand several inventions to be examined.



SIEMEN'S AND HALSKE'S ELECTRIC LAMPS.



GRINDING TWIST DRILLS.



LATHE CHUCK-PLATES.

LATHE CHUCK-PLATE.

By Joshua Rose, M.E.

The chuck-plate is simply a large face plate (its diameter being, usually, nearly as large as the full swing of the lathe). It is provided with radial slots and numerous square holes (as shown in Fig. 1), to receive bolts and other devices employed to clamp work to its radial face. Its radial face should be a true plane (as indeed should the faces of all face plates and chucks), standing at a right angle to the line of centres of the lathe, and should run true. If a face plate is hollow when tested by a straight edge placed across its radical face, work that should be held true by being bolted against its face will not be true unless it is truly cylindrical and is fastened centrally on the chuck-plate.

For example, Fig 2 represents a chuck-plate hollow across the face. A is the chuck-plate shown in section, and B is an arm having a hole through its double eye, C, and one through its hub, D. The centre line of the lathe is denoted by E E, while the centre line of the hole in D is denoted by F. Now, suppose that the hole in D had been bored, and the radial face of D (which is against the chuck-plate) was turned true with that hole, when bolted to the chuck-plate, the centre line of F not being parallel with E, and the latter representing the line of travel of the cutting tool, it is obvious that the hole in C will not be bored parallel to that in D. If the chuck-plate was rounding instead of hollow, a similar error in parallelism would occur, but it would exist in the opposite direction, the centre line of D standing as denoted by the dotted line, G.

It is obvious, therefore, that the face of the plate should be true as tested by a straight edge, and that the plane of its face should stand at a right angle to the line of centres of the lathe. It is better, however, that whatever amount of error there may be should be in hollowness rather than roundness, for the following reasons:—In Fig. 3 is shown a face plate that is hollowing, and in Fig. 4 one that is rounding. Both are shown carrying a truly cylindrical washer, bored true, faced and recessed on one side, and chucked to be turned up true on the other.

A A are the chucks shown in section, and B are the respective discs held to the chuck-plates by the plates, C, and bolts, D, while E represents the lines of centres of the lathe. The face, F, of the washer in Fig. 3 stands at a right angle to E, notwithstanding the hollowness of the chuck-plate, while the face, F, in Fig. 4 may stand at an angle, as shown, in which event truing up the face, G, would leave the washer thinnest at one part of its circumference and thickest on the diametrically opposite side. The truth of the chucking in this case depends on whether the clamps, C, were screwed by the bolts with equal force to the face plate. A hollow chuck-plate will lose this advantage in proportion as the work covers more of one side of the chuck-plate than it does of the other, but in any event it will chuck more true than a rounding one. Suppose, for example, that instead of the discs being chucked concentric to the chuck they were chucked eccentrically, as shown in Figs. 5 and 6, the chucks being the one as much hollowing as the other is rounding. That shown in Fig. 5 would stand out of true to an amount greater than is the chuck in the length of its radius, while that shown in Fig. 6 would be nearer true than is the chuck in the length of its radius, both amounts being in the proportion of the length of the line, A, to the length of the line, B, the line of centres of the lathe being E E.

If either of these errors are known to exist, pieces of paper of sufficient thickness to remedy the error may be placed at C and D respectively. It is better, however, to true up the faces of plates so that the surface of the work bolted against it will be true and stand at a right angle to the line of lathe centres.

In truing up a face plate, the bearings of the live spindle should be adjusted so that there is no play on them, and the screw or other device used to prevent end motion to the live spindle should be properly adjusted.

A bar or rod of iron should also be placed between the lathe centres to further steady the live spindle, and the square holes or radical slots should have the edges rounded or bevelled off as shown in Fig. 7, so that when the tool point strikes the sides, A, of the holes or slot, it will leave its cut gradually and not with a sudden jump or jerk, while, when it again meets the cut on the side, B, it will take the cut gradually, and will not meet the sand of the casting, which would rapidly dull the tool-cutting edge.

The first or roughing cut should be commenced at the circumference of the chuck, and fed towards the centre for the following reasons :—Suppose Fig. 8 represents a chuck-plate, the two tools, A B, taking their respective cuts. The metal being cut by B will sever more easily from the main body than will that cut by A, because it is not so well supported by the metal behind it ; hence less strain under equal depths of cut is sustained by B than by A, and it will, therefore, not dull so quickly.

In turning up a new chuck-plate it may be necessary to take off three cuts, in which event the second should also be fed from the circumference to the centre. In truing up a chuck-plate that has worn out of true, or in taking the finishing cut on a new one, the straight-edge should first be applied to the face, and if the latter is found to be rounding, the finishing cut should be started of the centre and fed to the outside, so that whatever amount the tool-edge may wear away in traversing across the face, will tend to strenghten the face, whereas were the cut started from the perimeter and traversed inwards, the roundness of the chuck would be increased to the amount of the wear of the tool. Conversely it is obvious that if the plate is hollowing, the cut should be started from the outside and fed inwards.

If the lathe has a self-acting feed motion, that motion should be put in gear, and the cut put on by operating it by hand, the object being to prevent the lathe carriage from moving back while the cut is proceeding.—*English Mechanic.*

Miscellaneous.

A Curious Mode of taking Turtle.—In the neighbourhood of Cuba a peculiar method of securing the turtle is pursued by the natives, advantage being taken of the habits of a species of remora, or sucking-fish, peculiar to those waters. Three or four species of remora are known, having collectively a wide range. The white-tailed remora (*Echeneis albicauda*, Mitch.) frequents our North Atlantic coast, and is sometimes taken in Long Island Sound, where it is known as the shark-sucker. The chief peculiarity of all these fish consists in an oval disc on the top of the head and the adjacent parts of the back, the surface of which is crossed by transverse cartilaginous plates, arranged somewhat like the slats of a Venetian blind ; on the middle of the under surface are hook-like projections, connected by short bands with the skull and vertebræ, and their upper margin is beset with fine teeth. According to De Blainville, this organ is an anterior dorsal fin, whose rays are split and expanded horizontally on each side, instead of standing erect in the usual way. By means of this apparatus, partly suctorial, partly prehensile by the hooks, the remora attaches itself to rocks, ships, floating timber, and the bodies of other fish, especially sharks, which it uses either for anchorage or for labour-saving transit. The species of remora inhabiting Cuban waters (called Revé—that is, reversed—by the Spaniards, because its back is usually mistaken for its belly) is employed by the native fishermen. The boatmen in quest of the turtle carry several revés in a tub, and when they approach their game a properly tethered revé is cast off. On perceiving the turtle the fish quietly attaches itself so firmly that the prize can be easily secured. Colcomb states that the fish's hold is so strong that it will allow itself to be torn asunder without letting go. This living fish-hook is held by means of a ring attached to the remora's tail, and a stout line made of the fibre of palm bark. By a peculiar manipulation the fish is induced to let go its hold upon the turtle, when both have been hauled into the boat. The remora is then returned to its tub, to await the discovery of another turtle.

The Milk of the Cow Tree.—Alexander Humboldt remarks that among the many very wonderful natural phenomena which he had during his extensive travels witnessed, none impressed him in a more remarkable degree than the sight of a tree yielding an abundant supply of milk, the properties of which seemed to be the same as the milk of a cow. The tree itself attains a height of from 45 ft. to 60 ft., has long alternate leaves, and was described by Linden as *Brosimum galactodendron.* The milk which flows from any wound made in the trunk is white and somewhat viscid ; the flavour is very agreeable. Some time ago, on the occasion of M. Boussingault going to South America, Humboldt requested him to take every opportunity of investigating this subject. At Maracay the tree was first met with, and for more than a month its excellent qualities were daily tested in connection with coffee and chocolate ; but there was no opportunity for a chemical analysis. Nor does such appear to have occurred till the other day, when, amid the many curious things exhibited by the Venezuelan Government at the Paris Exhibition, there happened to be several flasks of this milk ; and after a long period M. Boussingault has been enabled to complete his analysis of this substance, which is unique in the vegetable world. In a memoir laid before the Academy of France he gives a detailed analysis, and concludes by stating that this vegetable milk most certainly approaches in its composition to the milk of the cow ; it contains not only fatty matter, but also sugar, caseine, and phosphates. But the relative proportion of these substances is greatly in favour of the vegetable milk, and brings it up to the richness of cream, the amount of butter in cream being about the same proportion as the peculiar waxy material found in the vegetable milk, a fact that will readily account for its great nutritive powers.

A remarkable accident happened a few weeks ago at l'Ecole Normale to M. Zédé, who was studying the properties of a composition formed of equal parts of gun-cotton and nitrate of ammonia. This was inflamed in a bronze tube of 6mm. internal diameter, and expanded without detonation. Thirty experiments had been made, and M. Zédé then reduced the size of the tube to 5mm. When he tried the experiment anew under these conditions a frightful explosion occurred. The tube was shattered into 60 pieces, some of which passed through the roof of the laboratory and penetrated about 4 ctr. into a brick wall. The operator had one of his legs broken.

This accident is engaging the attention of the French Commission des Poudres et Salpêtres. M. Saint Claire Deville, in the Academy, pointed out that the fact belonged to a category including already several others, and he recalled an observation by Prof. Abel. About 0·2 gr. of chloride of nitrogen is placed in a watch-glass, and exploded with a piece of phosphorus ; the noise is tremendous, but the explosion has little or no shattering effect. Now repeat the same experiment, after having breathed on the chloride so as to deposit a thin envelope of moisture (which cannot be more than a thousandth of a mm. thick). In this case the explosion is less noisy, but the effects are quite different. Not only is the glass pulverised, but the table supporting it is perforated.

Two deaths, under peculiar and painful circumstances, are recorded in a recent number of *Les Mondes.* One was that of a farmer of Landas, who took a foolish bet that he would swallow his pipe, the stem of which was 10 centimetres. He did so, then returned it intact ; but he died ten hours afterwards. The other case is that of a young man who was leaving Paris for Lyons to visit his family, whom he had not seen for long. At the station, before entering a carriage, he wished to smoke a cigarette, and lit the match by scratching the phosphorus with his finger-nail. Some of the incandescent phosphorus penetrated under the nail, producing a burn, to which he gave no heed. In an hour, however, the pain was intolerable ; finger, hand, and forearm swelled and inflamed. He got out and went to a doctor, who said immediate amputation of the forearm was absolutely neeessary. The man wished to wait a while, and telegraphed for his father, who, however, arrived too late. The purulent disorder reached the shoulder, and operation was now impossible. Death ensued in twenty-eight hours.

BONE AND MUSCLE.

Liebig has shown that oatmeal is almost as nutritious as the very best English beef, and that it is richer than wheaten bread in the elements that go to form bone and muscle. Prof. Forbes, of Edinburgh, during some 20 years, measured the breadth and height, and tested the strength of both the arms and loins of the students in the university—a very numerous class, and of various nationalities, drawn to Edinburgh by the fame of his teaching. He found that in height, breadth of chest and shoulders, and strength of arms and loins, the Belgians were at the bottom of the list ; a little above them the French ; very much higher the English ; and the highest of all the Scotch and Scotch-Irish, from Ulster, who, like the natives of Scotland, are fed in their early years with at least one meal a day of good oatmeal porridge.

ELECTRIC BREVITIES.

Division of the Electric Light.—The mode in which this is effected is by parting a large wire into numerous branches, each branch of the same length and conducting power, and receiving an equal proportion of the current. The branches are further sub-divided, and the supply of the lateral stems similarly regulated. In practice, Mr. Edison will make use of two large main wires of copper, one for the outflow of the current from the machines, the other for its return. The mains will not be united at the outer ends. The positive wires will throw out a branch into each building it passes which takes the electric light. This branch will return to the negative main, thus completing the circuit. It is expected that the current can thus be sub-divided any number of times. The mains are to be supplied with a deluge of electricity, if the expression may be allowed, generated by magnetic machines, built for quantity and not for intensity, and it is expected that each building will receive its proportional share of the current. A sub-division of the current has been patented, by which the lights are placed in branch circuits, running across from the positive to the negative conductor; any number which the machine will support may be used and governed by switches.

A New Detective.—A gentleman living near Calcutta has discovered a new practical use for the microphone, which promises to render it useful in the detection of crime. Having for some time missed oil from his godown, he fixed up a microphone near the oil cans, carrying the wire up-stairs to his bedroom, and after the house had been closed for the night, sat up to await the result. He was not long waiting before he heard the clinking of bottles, followed by the gurgling sound of liquid being poured from one receptacle to another. Hastening down he caught his bearer *in flagrante delicto*, filling small bottles with oil for easy conveyance from the premises.

Color of the Electric Light.—By the combination of the suitable chemicals during the manufacture of the carbons, or by saturation afterward, almost any colored tint may be obtained. The natural violet rays are neutralized by the addition of a few grains in each carbon of chloride of sodium, producing a yellow tint like the sunlight. Magnesia produces a very white light, and is well adapted to photography. A mixture of arsenic, on the contrary, produces a light almost devoid of chemical effect. Various proto-salts and sulphates of the metals may be so combined as to produce almost any desired color.

The Electric Light Put Out.—Several American manufacturers who had introduced the electric light into their works, have withdrawn it, owing to the intermittent character of the light used, thus injuriously affecting the optic nerves of the workmen, interfering with a steady gaze. This intermission is not unfrequently due to the engine employed for working the generating machine being employed for other operations, and is not a necessary feature of electric lighting.

How Edison's Light is Produced.—The light is produced by incandescence. The conductor, which is made incandescent by the electrical current passing through it, is a small, curiously shaped apparatus, consisting of a high alloy of platinum and iridium, which can not be melted under 5,000 degrees Fahrenheit. A sufficient quantity of this metal is placed in each burner to give a light equal to that of a gas jet.

Edison's Claim to an English Patent Secured.—The British Commissioners of Patents have decided favorably on Mr. Edison's claim to a patent for his mode of producing, sub-dividing, and distributing the electric light.

Wirebound Sheaves and the Millers.—The millers of the Western States of America have set themselves against the use of wire-binding reaping machines on the ground that the wire gets into the flour and offal, and injures the milling machinery. The Minnesota millers have agreed not to buy wheat that has been bound with wire, except at a reduction of 10 cents per bushel. As nearly all the self-binding reapers of America bind with wire, this proposed action of the millers is a serious one for the farmers, and for the makers of the American sheaf-binding reaping machines. It is doubtful, however, whether they will have power to carry it into effect. No string-binder has yet been uninterruptedly successful in ordinary field use, though two or three are now before the public, and will probably be perfected after another harvest.

To Cast Brass Solid.—The metal should not be run any hotter than is necessary to insure sharp casting. The most probable cause of the honey-combings of castings is that the air can not get out of the way; and there ought to be proper vents made for it from the highest parts of the mold; the metal should be run in near or at the bottom of the mold. If about one pound of lead be added to every 16 pounds of old brass, when just at the melting point, solid good brasses will be the result. In melting old brass, the zinc, or lead, contained in it (when fluid) oxidizes freely, consequently the proportions of the metals are altered, and require an addition similar to the above. If the brass has not been recast, a little less lead will do, but if recast several times, it may take the full quantity.

Mechanics.

Curious Facts about Iron.—Colonel Cazen, in a recent article on the subject, says: During his sojourn in the arm manufactories of St. Etienne and Tulle, at the central depot of artillery, and at the manufactory of Chatelleranlt, he was able to make important researches on iron. The fracture of iron may be nervous, in grains more or less fine, or in facets sometimes having a surface of several square millimeters; often it presents a mixture of these three features. Thus it is impossible to judge of the quality of an iron before breaking it; and it is on this account that in arm manufactories they break a certain number of bars with which they make a certain number of pieces for which they are intended, and which are afterwards broken to ascertain their resistance—that is, the goodness of the iron, which, moreover, is still rendered brittle in presence of phosphorus, arsenic, or sulphur. The best irons are the nervous, then those of fine grain and with facets. On railways it has been proved that rails placed in the direction of the magnetic meridian are affected quite differently from rails placed at right angles to this direction; the former oxidize and do not become brittle. In intermediate directions the rails participate more or less in the qualities of those which are placed in the two extreme directions. What becomes of the iron which is now so plentifully used in the construction of buildings—girders, among others?

Apparatus for Feeding Boilers.—Signor Chiazzari, of the Alta Italia Railway, has recently described a new apparatus for feeding the boilers of locomotives and other non-condensing engines with water heated to within a few degrees of the boiling point. The apparatus consists in bringing the feed-water in a finely divided spray into contact with a portion of the exhaust steam during its passage through the feed pump, and of an automatic arrangement for shutting off the supply from the tender the moment the regulator is closed, thus preventing the admission of cold water to the boiler. Mechanically the pump appears to be successful, as it has worked without trouble since January, 1876. Economically it seems also to have answered, for the saving in fuel, in a trial of four months, is said to have been very large.

Electric Car Signal.—A trial will soon be made of a new signal recently patented by Mr. I. A. Sherman and Mr. C. E. Mees, of Louisville, Ky. The first named gentleman is an accomplished electrician, and connected with the Louisville and Nashville Railroad. The invention consists in combining a signal device upon the locomotive with two conducting wires extending through the cars of the train, and terminating at the end of each car in adjacent contact plates, forming seats, together with a flexible cable having two insulated wires terminating in metal plates separated by a soft rubber block, to continue the circuit, but permitting it to be broken when the cars separate, and transmit a signal to that effect to the engineer. It can be applied to freight as well as passenger cars. The cost will be something more than that of the system now generally in use.—*Nat. Car-Builder.*

Cement for Fixing Metal Letters on Glass.—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.

A new clay mosaic is being brought out, the advantages claimed for which are that one setting is sufficient for one hundred copies, the cost being comparatively small. It is said to wear well.

The Electric Light Company of Baltimore, Md., has been formed, with a capital of $300,000, to produce light, heat and power by electricity.

Machine Construction & Drawing.

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

(*Continued from page* 127.)

As our space would not admit of the continuation of this work in May number, we give this month 2 extra pages. The plates we cannot furnish until near the completion of the work, which will be completed before the end of the year.

The value of this work cannot be too much appreciated by young machinists. They are actually getting a work for nothing that cost $2.

43. We will now define the term *pitch*, so that it shall be independent of the number of threads in the screw, which we consider to be the clearest manner of expressing it. In all cases either the screw or the nut is fixed, and prevented from moving lengthwise (in direction of the axis of the screw); we shall consider the nut to be the moving piece, as being most suitable for the definition. The *pitch* of a *screw* is the distance moved through by the nut during one revolution of the screw. To find the size or thickness of the thread for square-threaded screws, divide the pitch by twice the number of threads in the screw, and the quotient will be the required size. In fig. 96, ab = the pitch, and therefore the thickness of the thread = $\frac{1}{2}$ ab.

44. Screws are right or left-handed, according to the direction in which the nut moves; when the screw is turned round in the direction of the hands of a watch, the nut moves in the direction ba, figs. 92, 94, 96, *from left to right*, the screw is therefore *right-handed;* and *left-handed* if *vice versâ*.

A left-handed square-threaded screw, $2\frac{1}{2}''$ diameter, $\frac{1}{2}''$ pitch, is shown in figs. 97, 98, drawn to a scale of $\frac{1}{4}$. Fig. 98 shows a common approximation to the true form of the thread. If the screw be turned round in the direction indicated by the arrows, the nut will move in the direction ab, *from right to left.*

Screws are considered to be right-handed single thread, unless otherwise stated. Left-handed screws are only used in special cases.

45. For square-threaded screws there is no strict standard for the number of threads per inch of length according to the diameter of the screw, as there is for the V-threaded screw. In some establishments the rule is, for the same diameter of screw, to allow the number of threads per inch to be one-half that of the V-threaded screw. This rule agrees very nearly with the following table :—

TABLE III.

Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.
$\frac{1}{4}$	10	$\frac{5}{8}$	7	1	5	$1\frac{3}{4}$	$2\frac{1}{2}$
$\frac{5}{16}$	10	$\frac{11}{16}$	7	$1\frac{1}{8}$	4	$1\frac{7}{8}$	$2\frac{1}{4}$
$\frac{3}{8}$	9	$\frac{3}{4}$	6	$1\frac{1}{4}$	$3\frac{1}{2}$	2	$2\frac{1}{4}$
$\frac{7}{16}$	8	$\frac{13}{16}$	6	$1\frac{3}{8}$	3	$2\frac{1}{8}$	$2\frac{1}{4}$
$\frac{1}{2}$	7	$\frac{7}{8}$	6	$1\frac{1}{2}$	3	$2\frac{1}{4}$	2
$\frac{9}{16}$	7	$\frac{15}{16}$	6	$1\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{1}{2}$	2

46. In this chapter we shall consider some of the kinds of wheels used as connecting pieces between shafts for the direct transmission of motion.

Spur Wheels are used for the purpose of transmitting motion from one shaft to another when the shafts are parallel. If the wheels are circular the motion is regular; and it is irregular in the case of *elliptic* and *lobed* wheels. We shall only consider the former kind, and confine ourselves to the simplest form of spur wheels, those having teeth projecting from the rim and parallel to the axis of the wheel. By giving proper diameters to the wheels we may obtain any required number of revolutions, within certain limits, for each shaft respectively.

47. In figs. 99, 100, Plate IX., A and B are the centres of two shafts, which are required to be connected by spur wheels, so that B shall make two revolutions to one of A. Required the diameters of the wheels. From A draw any line Ab, making an angle of about 30° with AB, and upon it set off Ac, cb, so that $Ac = 2cb$. Join Bb, and from c draw cC, parallel to Bb, cutting AB in C, then AC, BC are the required semi-diameters or radii. We could have found C by dividing AB by trial, as the division is a simple one; but the plan adopted can be applied whatever be the ratio of the diameters of the wheels, and is therefore a general solution. The wheel A we shall term the *driver* and B the *follower*.

The act of giving motion to a piece is termed *driving* it, and that of receiving motion from a piece is termed *following* it.*

In this example we have considered the wheels to be toothless, and to be *rolling* together without *sliding*, so that for each inch or fraction of an inch of the circumference of the wheel A passing the point C, an equal length of the circumference of the wheel B passes the same point. The two shafts rotate in opposite directions; thus, if A turns in the direction of the hands of a watch, B will turn in the opposite direction. Wheels used to transmit motion are usually provided with *teeth* to ensure regularity of motion and the transmission of greater force than could be obtained conveniently with toothless wheels. The circles CDE, CFH, then become the *pitch circles* of the wheels, which are situated near the middle of the length of the teeth. See Ch. IX. on the Teeth of Wheels.

48. The diameters of wheels are generally referred to their pitch circles; thus we speak of the diameter of the pitch circle of a wheel of, say, 30 *teeth*, 1″ *pitch*. Figs. 101, 102 represent a pair of wheels in *outline* (not showing the form of the teeth), A has 24, and B 18 teeth, $\frac{3}{4}''$ pitch. The *pitch* is the distance, measured along the pitch circle, from the centre of one tooth to the centre of the next tooth. In fig. 101 the dotted circle marked t represents the top, and that marked b the bottom of the teeth. A is a *plate* wheel, the *boss* is marked a; c is the plate, and d the *rim* of the wheel. The wheel B is solid, having projecting pieces, e, on each side, termed *facings*. The figures are drawn to a scale of $\frac{1}{4}$. To draw the wheels it is necessary to know the distance AB and the diameter of one of the wheels, from which we can readily obtain the diameter of the other, or the diameters of both wheels. We will take the problem as follows :—

49. Given the number of teeth and the pitch of a pair of spur wheels, and the kind of wheels (solid, plate, or with arms), to make a drawing of them in outline. Having drawn the common centre line AB, fix upon A or B for one centre; now find the diameter of each pitch circle, which may be done as follows:—The diameter of a circle bears a constant ratio to its circumference, the ratio is 1 : 3·1416, or 1 : $3\frac{1}{7}$ nearly, that is to say, the circumfer-

* *Principles of Mechanism*, by Prof. Willis.

ence is 3·1416 times the diameter; therefore, knowing the number of teeth and the pitch, we can easily find the diameters of the pitch circles. The number 3·1416 is usually denoted by the Greek letter π. Using decimals in our calculations we have $\frac{3}{4}'' = \cdot 75''$; therefore the circumference of $A = \cdot 75'' \times 24$; and the diameter $= \frac{\cdot 75'' \times 24}{3\cdot 1416} = 5\cdot 72''$ or $5\frac{3}{4}''$ nearly; the diameter of $B = \frac{\cdot 75'' \times 18}{3\cdot 1416} = 4\cdot 29''$ or $4\frac{5}{16}''$ nearly. From A set off $AC = \frac{1}{2}$ of $5\frac{3}{4}''$, and from C mark off $CB = \frac{1}{2}$ of $4\frac{5}{16}''$ (these dimensions being taken according to the scale of the drawing). From A and B as centres with radius AC, BC, respectively, describe the pitch circles PC. From C mark off along AB the top and bottom of the teeth of each wheel, making the top $\frac{5\frac{1}{2}}{15}$, and the bottom $\frac{6\frac{1}{4}}{15}$, of the pitch; through these points describe the circles *t*, *b*, for each wheel. The remaining dimensions for A are as follow:—Thickness of rim *d* $\frac{3}{8}''$; diameter of boss $2\frac{1}{4}''$, diameter of hole in boss for shaft $1\frac{1}{4}''$; key for shaft $\frac{5}{16}''$ square, fixed half in wheel and half in shaft; width of teeth *f* $1\frac{3}{4}''$; width through boss $2''$; and thickness of plate $\frac{3}{8}''$. These dimensions are usually given in terms of the pitch, to which we shall refer later on. In fig. 102 half of each wheel is in section.

50. We will give a formula which connects the three varying quantities (the pitch, number of teeth, and diameter) of the pitch circle. Let P stand for the pitch, D the diameter of the pitch circle, and N the number of teeth, P and D being given in inches and parts of an inch;—

$$\text{then } P \times N = D \times \pi \quad - \quad - \quad - \quad - \quad (1);$$

which may be put in the forms—

$$N = \frac{D\pi}{P} \quad - \quad (2), \qquad D = \frac{PN}{\pi} \quad - \quad (3).$$

If we know any two of the quantities N, P, or D, the third may be found. Equation (3) is the form most required.

51. Bevel Wheels.—If the shafts to be connected are not parallel, but lie in the same plane, bevel wheels are used to connect them. They consist of frusta of cones provided with teeth on the conical surface. We shall consider them in the first instance as toothless. First, when the shafts are at right angles:—Let it be required to connect the axes A and B (*aa*, *a'a'*, *bb*, *b'b'*), figs. 103, 104, by means of bevel wheels, so that A shall make two revolutions to one of B. Upon *b'b'*, fig. 103, set off from D along D*b'* any convenient length D1 as a unit of length; and upon *a'a'*, from D, a distance D2 equal to two of the same units of length. Upon D1, D2, describe the rectangle D1C2, and draw the diagonal DC. Let *e'f'* be the greatest radius of the driving wheel, draw *f'f* parallel to *a'a'*, meeting DC in *f*. Through *f* draw lines parallel to *a'a'* and *b'b'*; make $eg = ef$, and $hk = hf$; then *gf* and *kf* will be the required greatest diameters of the wheels. Join D*k*, D*g* (*k*D*g* will be a straight line), then D*fg*, D*fk* are two cones having a common vertex D, which, being centred upon the axes A and B (*a'a'*, *b'b'*), will revolve in contact so that the axis A shall make two revolutions while the axis B makes one. The line D*f* is the line of contact. Frusta of cones are used for the wheels, as shown in the figures. Fig. 103 is an elevation, fig. 104 a plan, of the wheels.

52. We will now extend the case to include bevel wheels whose axes are not at right angles; but, as in the former case, lying in the same plane. In figs. 105, 106, the axes A and B (*aa*, *bb*, *a'a'*, *b'b'*) are inclined at an angle of 60°, and when produced meet in a point D. It is required to connect the axes so that B shall make three revolutions to two of A, the greatest diameter of the wheel on A to be equal to *e'f'*, fig. 106. Draw the axes *b*D, D*a* to contain an angle of 60°. Upon D*a* set off D2 = 2 units of length (D1), and upon D*b* set off D3 = 3 of the same units. Upon D3, D2, describe a parallelogram D2C3, draw the diagonal DC, which is the line of contact. Draw *f'f* parallel to *aa*, meeting DC in *f*, through *f* draw *feg*, *fhk* perpendicular to *aa*, *bb*, respectively, making $eg = ef$ and $hk = hf$. Join D*k*, D*g*, then D*fk*, D*fg* are two cones which are the pitch surfaces of the required wheels, as in the last example; frusta of these cones are used for the wheels. The same equations are applicable for bevel wheels as those given for spur wheels in Art. 50, page 43.

53. We will now take an example, applying it to the case of equal bevel wheels with axes at right angles, called *mitre wheels*. Fig. 107 is an elevation, and fig. 108 a plan, of a pair of mitre wheels in *gear* of 24 teeth, 1″ pitch; the diameter of pitch circle = 7·636″, or $7\frac{5}{8}''$ nearly. Draw the centre lines *aa*, *a'a'*, *bb*, *b'b'*, and the pitch circles *kf*, *fg* in plan and elevation, join C*f*, C*g*, C*k*, fig. 108. From *f* draw *fe* perpendicular to C*f*, meeting the axis *aa* in *e*, and join *eg*; then *eg* is perpendicular to C*g*. Draw similar lines from *f* and *k* for the other wheel. From *f* along *lfe* set off the top *t* and bottom *p* of the teeth of each wheel, as shown at *g*; from each of these points draw lines to C. Upon *f*C or *g*C mark off *gm*, equal the width of the teeth, making both wheels similar. The construction lines show how to complete the drawing. The teeth of bevel wheels are made of the same size as the teeth of spur wheels of the same pitch at *tgp*, fig. 108, but as they radiate to a common centre C, they decrease in size the nearer they are to that centre. The following dimensions may be added:—Diameter of hole for shaft $1\frac{1}{2}''$; diameter of boss $2\frac{3}{4}''$; width through boss $2\frac{1}{8}''$; width of teeth *gm* $2\frac{1}{2}''$; and the key $\frac{5}{16}''$ square. The other proportions of the teeth are to be taken from one of the sets of dimensions given in Art. 66, page 51.

We shall treat bevel wheels more fully in the Advanced Work of this Series.

54. The connection between shafts by means of pulleys and bands for the transmission of motion.

Pulleys and Bands.—In the previous chapter we considered how motion could be transmitted by wheelwork; we shall now refer to a more simple and less expensive means of obtaining similar results; it is one, however, which can only be applied in cases where the motion transmitted may vary in extreme cases without causing serious inconvenience, as for instance, when one shaft turns round a fraction of a revolution more or less than the other. However, there are cases where pulleys and bands cannot be used for other reasons, but these refer more especially to the transmission of motion between shafts in machines where the space is limited, and where a direct connection is essential. The arrangement under consideration has many advantages over that of connection by wheelwork; one is that the shafts may be any distance apart within reasonable limits; and a second is, that any variation of the distance between the shafts does not alter their rate of motion, as the band can be adjusted to suit the change, and the pulleys can be made of a relative diameter, so as to produce the required number of revolutions per minute of each shaft independent of

Useful Receipts.

Imitation Carved Ivory.—A correspondent in the *English Mechanic* says—"Ornaments for the parlour," &c., may possibly find interesting and profitable amusement in the construction of articles in imitation carved ivory. I will endeavour to explain the *modus operandi*. In the first place we must have something to ornament—a work box, card case, a tea-caddy, or what-not. If the article is of mahogany, rosewood, or walnut, polished, we can only lay our "carvings" on it without disturbing the polish; but if common wood, or without polish, it must be coloured white, or ebonized. If, for instance, then, our work box is not made of white wood, we must take ½ oz. of isinglass, and boil it gently in half-pint of water till dissolved; then strain and add flake-white, finely powdered, till it is as thick as cream. Give the box three or four coats of this solution, letting each dry before the other is laid on; then smooth it with a bit of damp rag. When the composition is dry, we can put on imitation ivory figures, which are to be made as follows:—Boil ½ lb. of best rice in one quart of water, till the grains are soft enough to bruise into a paste; when cold mix it with starch powder till it becomes as stiff as dough; roll it out about as thick as a shilling. Cut it into pieces about two inches square, and let it dry before a moderate fire. When required for use, get a coarse cloth, make it thoroughly wet, then squeeze out the water, and put on a large dish four times double; place the rice cakes in rows between this cloth, and when sufficiently soft to knead into the consistence of new bread, make it into a small lump; if too wet, mix with it more starch-powder, but it must be sufficiently kneaded to lose all appearance of this powder before you take the cast. The moulds are gutta-percha, about ½ in. thick; cut it into pieces of 2 in. square, and soften it in hot water; then obtain, if possible, some specimen of real carved ivory or other suitable work, cameo-heads, *e. g.*, and take off the impression on pieces of gutta-percha, by pressing it carefully upon the carving till a deep impression is taken. When the moulds are quite dry and hard, and paste in a proper state, with a small camel-hair brush touch lightly with oil the inside of the moulds, and then press the rice paste into them. If the impression is quite correct on removing it, take a thin, sharp, small knife, and cut the paste smoothly, just so as to leave all the impression perfect; then, with a sharp-pointed pen-knife, turn all the rough edges, and with a solution of isinglass and acetic acid, or liquid glue, place the figures on the box in large or small pieces, just as your own taste directs. The figures adhere better if put on before they are quite dry. Sometimes, from frequent kneading, the paste gets discoloured; these pieces should be set aside and used separately, as they can be painted in water-colours to imitate tortoise-shell or carved oak; this should be done after being stuck to the box. Having completed the work, finish by varnishing it very carefully with ivory varnish, which should be almost colourless; paper varnish or the best "white hard" will answer very well. This design so nearly resembles carved ivory, that it has been mistaken for it when nicely done; and it is very strong if carefully cemented, and looks well for boxes, card-cases, &c., either as ivory or tortoise-shell. Instead of oiling the mould a pleasing effect can be produced by using powdered French chalk (steatite) or black-lead, as the lubricating medium between the paste and the gutta-percha. The objects when cast may be readily dyed with liquid colours, such as the aniline dyes. The "carvings" must be thoroughly dried before the varnish is laid on, so the work must be put away in some place free from dust, till it can be completed.—*Quinton.*

To Fix Drawings.—The first methods for fixing works of art executed in chalks, charcoal, and other substances in danger of destruction from the slightest touch, date from very far back, and in some cases are perfectly successful. Sometimes the drawing is rapidly dipped into a bath of some glutinous liquid, and sometimes the liquid itself is applied with a brush. This, however, cannot be done with chalk or charcoal drawings. A very thin and transparent sheet of bibulous paper is laid on the drawing, and the brush is then passed over the protecting sheet; the glutinous liquid penetrates to the drawing, and the wished-for effect is produced. In the case of chalk drawings (pastels), however, this process has the inconvenience that certain tints, on being wetted, change their tone, and do not return to their former state on drying. This circumstance led to some experiments with a view to find a better fixing fluid, and after many trials it was found that the psilicates of potash and soda answered very well, but with the drawback that during the application the colours were likely to be disturbed so as to give the appearance of being "smudged." At length, however, this was obviated by a very simple plan, merely executing the pastel upon a thick but unsized paper, such as is used in copper-plate printing, and afterwards applying the fixing liquid to the back; it is thus quickly absorbed, without causing any disturbance of colours on the other side. To this must be added that none but mineral colours should be used, these being the only ones that can combine with the silicates, which have no action on vegetable colours. These rules being observed, the picture will not only resist damp, but will even resist washing with water. Acid vapours have no effect upon it, and it will become almost incombustible. For pencil drawings a thin solution of isinglass answers the purpose. It should be allowed to run over the drawing, or be very carefully applied with a soft camel's hair pencil. For chalk drawings make a thin solution of size, put it into a flat dish, pass the drawing from one side to the other under the liquid, taking care that the liquid comes in contact with every part of it. The friction of camel's hair pencil would injure the drawing. When it is completely wetted, fasten it to the edge of the table or to a string, by means of two or three pins, until dry. Crayon or charcoal drawings would be spoiled by this process, and for fixing them the paper should be washed over with a solution of size in the first instance. When quite dry the surface is in a good state for making the drawing, after which it should be inverted and held horizontally over steam. The steam melts size, which absorbs the charcoal or crayon, and when it has again become dry the drawing is fixed. This process may be repeated several times during the progress of a drawing, the effect being increased each time.

Imitation Ivory Carvings.—"Quinton," whose account of this process we have already quoted, further says:—"The quantity of starch powder varies with the quality of the rice paste, but certainly half a pound ought to be sufficient for half a pound of rice. Boil the latter thoroughly, by which time the quart of water will be considerably reduced, but if the paste is too thin it will be a guide to boil longer till the water is still further reduced. A little boiled sago may be added when the paste is found to be too thin. Like everything else, the art requires practice before you become proficient in it. Isinglass size may also be used, and many other things which I did not think it necessary to mention in these columns. As to ebonizing wood the receipt has been given before; but here is a method that I use with success. Take a pint of water that has been boiled; put in a handful of logwood chips, and simmer till you have a strong decoction—about a quarter of a pint. Apply this liquor hot to the wood to be stained, about two or three times according to the nature of the wood, letting each coat dry thoroughly. Add about half a pint of boiled water to the remainder of the solution, and place in it some rusty nails or some sulphate of iron, and a couple of bruised nut-galls; boil, and apply two or three coats hot. This solution should be black, so the right quantities are easily ascertained. The stains should be prepared in a glazed pipkin, and be applied with a sponge or clean brush; but each coat of both liquids must thoroughly dry before putting on another, going over the work also with a very fine glass-paper. When the stain has become dry, get some French polish and add sufficient thumb-blue (any oilshop) to slightly colour the polish; apply in the usual manner, doing the work in a dry and warm room. This method produces an appearance equal to that of ebony. Beware of grease."

Imitating Rosewood.—1. A transparent liquid rosepink, used in imitating rosewood, consists in mixing ¼ lb. potash in 1 gallon hot water, and ½ lb. red sanders wood is added thereto; when the colour of the wood is extracted, 2½ lbs. gum shellac are added and dissolved over a quick fire. The mixture is then ready to be used on a groundwork made with logwood stain.—2. Boil ½ lb. logwood in 3 pints water till it is of a very dark red, and add ½ oz. salts of tartar. While boiling hot, stain the wood with two or three coats, taking care that it is nearly dry between each; then with a stiff flat brush, such as is used by painters for graining, form streaks with black stain. This imitation will very nearly equal the appearance of dark rosewood.—3. Stain with black stain, and when dry, with a brush as above dipped in the brightening liquid, form red veins in imitation of the grain of rosewood. A handy brush for the purpose may be made out of a flat brush, such as is used for varnishing; cut the sharp points off, and make the edges irregular by cutting out a few hairs here and there, and you will have a tool which will actually imitate the grain.

A Fast Cement.—A very valuable cement has been discovered by Mr. A. C. Fox, of which details are published in *Dingler's Polytechnisches Journal*. It consists of a chromium preparation and isinglass, and forms a solid cement which is not only insoluble in hot and cold water, but even in steam, while neither acids or alkalies have any action upon it. The chromium preparation and the isinglass or gelatine do not come into contact until the moment the cement is desired, and when applied to adhesive envelopes, for which the author holds it to be especially adapted, the one material is put on the envelope covered by the flap (and therefore not touched by the tongue), while the isinglass, dissolved in acetic acid, is applied under the flap. The chromium is made by dissolving crystallised chromic acid in water. You take:—

	Grammes.
Crystallised chromic acid	2.5
Water	15
Ammonia	15

To this solution about ten drops of sulphuric acid are added, and finally thirty grammes of sulphate of ammonia, and four grammes of fine white paper. In the case of envelopes, this is applied to that portion lying under the flap, while a solution prepared by dissolving isinglass in dilute acetic acid (one part acid to seven parts water) is applied to the flap of the envelope. The latter is moistened, and then is pressed down upon the chromic preparation, when the two unite, forming, as we have said, a firm and insoluble cement. In the case of mounting cartes-de-visite or other photographs, it would perhaps be wisest to apply the chromic preparation uniformly to the mounts first of all, and permit these to dry, when they would be ready for use at any moment. The print would then merely have to be faced with the solution of isinglass and acetic acid, and pressed to the mount. We have ourselves no practical experience of the cement, but it would be well worthy of trial by photographers.

Imitation Inlaying.—Suppose I want an oak panel with a design inlaid with walnut. I grain the panel wholly in oil. This is not a bad ground for walnut. When the oak is dry, I grain the whole of the panel in distemper. I have a paper with the design drawn thereon, the back of which I rub with whiting, place it on the panel, and with a pointed stick trace the design. I then with a brush and quick varnish trace the whole of the design. When the varnish is dry, with a sponge and water I remove the distemper, where the varnish has not touched. This, if well executed, presents a most beautiful imitation of inlaid wood. Marbles are executed in a similar manner.—*S. B. D.*

Kerosene Dangers.—A correspondent mentions a source of danger in using kerosene lamps which seems to have been generally overlooked, namely, the habit of allowing lamps to stand near hot stoves, on mantelpieces, and in other places where they become heated sufficiently to convert the oil into gas. Not unfrequently persons engaged in cooking or other work about the stove will stand the lamp on an adjacent mantelpiece, or even on the top of a raised oven; or when ironing will set the lamp near the stand on which the heated iron rests. It is needless to enlarge upon the risky character of such practices.

Method of Cleaning Prints.—Immerse the print for an hour or so in a ley made by adding to the strongest muriatic acid its own weight in water, and to three parts of this mixture adding one of red oxide of manganese. A print, if not properly clean, may remain in this liquid for twenty-four hours without harm. Indian ink stains should in the first instance be assisted out with hot water; pencil marks taken out with indiarubber so carefully as not to injure the engraving. If the print has been mounted, the paste on the back should be thoroughly removed with warm water. The saline crystal left by the solution may be removed by repeated rinsings in warm water.—*Art Union.*

Cleaning Engravings.—Put the engraving on a smooth board and cover it thinly with common salt finely powdered. Squeeze lemon juice upon the salt so as to dissolve a considerable portion of it; elevate one end of the board so that it may form an angle of about 45 or 50 degrees. Pour on the engraving boiling water from a tea kettle until the salt and lemon juice be all washed off. The engraving then will be perfectly clean and free from stains. It must be dried on the board or some smooth surface gradually. If dried by the fire or the sun it will be tinged with a yellow colour.

How to make Plaster of Paris hard enough for turning.—Mix with fresh plaster of Paris from two to four per cent of powdered marsh mallow root, then add sufficient water until it forms a mass. This will set in about an hour and become so hard and dry that it may be sawed and turned. It is used in the manufacture of dominoes, dice, &c. When eight per cent of the root is added a still harder mass is obtained which may be rolled into leaves and painted or varnished.

A small quantity of alum added makes it set harder and quicker.

Diamond Cement.—Diamond cement, or whitefish glue, is made of isinglass dissolved in dilute spirits of wine or common gin. The two are mixed in a bottle loosely corked, and gently simmered in a vessel containing boiling water; in about an hour the isinglass will be dissolved, and ready for use. When cold, it should be an opaque, milk-white, hard jelly; it is re-melted by immersion in water, but the cork should be at the same time loosened. After a time a little spirit should be added to replace that lost by evaporation.—*The Boston Cabinet-Maker.*

To Gild a Small Wooden Flower-Stand.—Rub the wood smooth, and prime with glue size; then put on two coats of oil paint and one of flatting. Smooth over, when dry, with wash-leather. Put on gold size, and when it is sticky to the touch, it is ready for the leaf, which put on carefully and dab with cotton wool. A thin transparent glazing can be used to deaden the gold in places.—*Scientific American.*

SIEMENS' AND HALSKE'S ELECTRIC LAMPS.

The distinguished firm of electrical engineers, Messrs. Siemens and Co., have patented several forms of electric lamps, most of them in the names of Siemens and Halske, the proprietors of the Siemens dynamo-electric machine. Perhaps the most useful regulator devised by them is their modification of the Serrin, but the illustrations on page 182 will serve to exhibit the diversity of form taken by lamps using only the common rods of carbon. In Fig. 1 the carbons fall to each other, but are separated at their upper extremities by a rod formed of some refractory substance. This rod is moved in a vertical direction by the lever arm L, which is actuated by the electro-magnet. When the current passes through the electro-magnet and the carbons, the rod, R, thrusts the carbons apart. If the current should decrease in strength, the carbons fall together again. The current is not broken by any similar lamp on the circuit failing to perform its function. In Fig. 2 one carbon is set in oscillation or vibration by means of the lever arm, D, which is terminated by an iron cylinder forming the movable core of the electro-magnet. The carbon has to vibrate merely 32 times a second to cause the appearance of a steady light. The lamp admits of several lights in the same circuit. Fig. 3 represents another form of the same idea, and resembles in its chief features the lamp invented by Profs. Elihu Thompson and E. J. Houston. The upper carbon falls gradually upon the lower, which is set into vibration by means of the lever arm, L, actuated by the electro-magnet. The lower carbon moves so quickly that the upper carbon, which is forced down merely by its own weight, cannot sympathise with it, and a small voltaic arc is therefore produced. The fluctuations of this arc are so rapid (about 30 per second) that they produce no apparent alternation in the light.

THE MYSTERIES OF A LUMP OF COAL.

For years no one supposed that a lump of soft coal, dug from its mine or bed in the earth, possessed any other purpose than that of fuel. It was next found that it would afford a gas which was combustible. Chemical analysis proved it to be made of hydrogen. In process of time mechanical and chemical ingenuity devised a mode of manufacturing this gas, and applying it to the lighting of buildings and cities on a large scale. In doing this, other products of distillation were developed, until step by step, the following ingredients are extracted from it:

1. An excellent oil to supply lighthouses, equal to the best sperm oil, at lower cost.
2. Benzole—a light sort of ethereal fluid which evaporates easily, and, combined with vapour or moist air, is used for the purpose of portable gas lamps, so-called.
3. Naptha—a heavy fluid, used to dissolve gutta-percha, India rubber, etc.
4. An excellent oil for lubricating purposes.
5. Asphaltum, which is a black, solid substance, used in making varnishes, covering roofs, and covering over vaults.
6. Paraffine—a white crystalline substance, resembling white wax, which can be made into beautiful wax candles; it melts at a temperature of 110°, and affords an excellent light. All these ubstances are now made from soft coal.

the distance between them. One important advantage of the pulley and band arrangement is, that if, through accident or otherwise, any sudden strain is thrown on, which might cause breakage in wheelwork, the band will *slip* on the pulley; by adjusting the band any required degree of tension may be obtained.

55. The band or other connecting piece between the pulleys is made of various materials and of two principal forms—flat and round. As the flat band (belt or strap) is the one chiefly used, we shall confine our examples to this form. The material commonly used is leather, as it possesses several important qualities suitable for the purpose; there are, however, several composite materials used for the purpose.

56. In figs. 109, 110, S_1, S_2 represent two parallel shafts, of which S_1 is the driver; they are to be connected by pulleys and belt, so that for every revolution of S_1, S_2 shall also make a revolution, and the direction in which they turn shall be the same, as shown by the arrows in fig. 109. The diameters of the pulleys on S_1 and S_2 will therefore be equal, as would be the case if they were toothed wheels. The amount of belt surface in contact with the pulley on S_1 is equal to *aa*, and that on S_2 to *bb*; and as the pulleys are of the same diameter *aa* = *bb*.

This is termed the *open belt* arrangement.

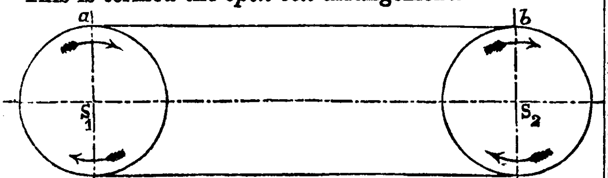


Fig. 109.

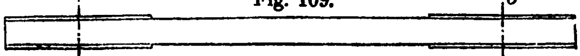


Fig. 110.

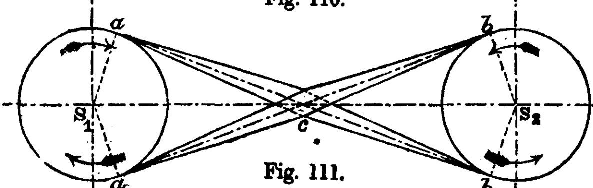


Fig. 111.

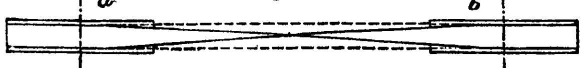


Fig. 112.

57. If the shafts are required to turn in opposite directions the belt is *crossed*, as shown in figs. 111. 112: not only is a difference produced in the direction of the motion of the shafts, but also a greater amount of belt surface is brought into contact with the pulleys than in the open belt, as shown at *aa*, *bb*, fig. 111. The belt, in passing from *a* to *b*, turns through two right angles; at *c*, where the two portions of the belt, *ab*, *ab*, cross, they are at right angles to the position in which they leave the pulleys at *aa*, *bb*.

58. In the two examples shown in figs. 109-112 the pulleys are of equal diameter, therefore the number of revolutions of each pair of shafts will be the same; but by varying the diameters of the pulleys in the same manner as in a pair of toothed wheels, we can give any ratio of number of revolutions to the two shafts within certain limits; for example, if the pulley on $S_1 = 24''$ diameter, and that on $S_2 = 8''$ diameter, then S_2 will make three revolutions to one of S_1.

When a very great difference in the number of revolutions of two shafts is required, one, two, or more intermediate shafts and pulleys may be employed.

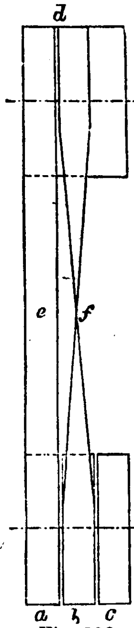


Fig. 113.

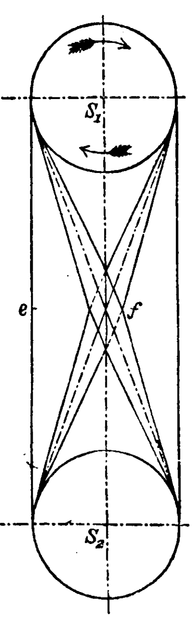


Fig. 114.

59. Pulleys are generally curved on the outer surface, as at *pq*, fig. 119, Plate XII., which tends to keep the belt on the pulley. The greatest diameter of the pulley is in the middle of its breadth *pq*; and as the tendency of the moving belt is to rise to the highest part of the pulley, the belt is thereby kept central on the pulley; the convexity = ½″ per foot of the breadth of the pulley.

60. The two arrangements shown in figs. 109-112 are often combined and employed as a reversing motion, which is illustrated in figs. 113, 114, where S_1, S_2 are two shafts, S_1 being the driver and S_2 the follower; *a*, *b*, *c* are three pulleys on the shaft S_2; *a* and *c* are keyed to the shaft, but *b* is loose upon it, so that it may turn without turning the shaft; *d* is a pulley keyed to the shaft S_1. Two belts are used, an *open* one *e* and a *crossed* one *f*, and they are so arranged that one of them is always upon the loose pulley. In the position shown in fig. 113 the open belt is on the fast pulley *a*, and the crossed one on the loose pulley *b*, so that S_2 turns in the same direction as S_1; if now the two belts are moved so that *e* is upon the pulley *b*, and *f* upon the pulley *c*, then S_2 will turn in the opposite direction to S_1. By this means a *reversing motion* is obtained for the shaft S_2. It is employed in planing machines, screw-cutting lathes, &c.

61. By using a fast and a loose pulley on the shaft S_1 and a single belt, the shaft may be stopped and started at pleasure; this is termed the *fast* and *loose* pulley arrangement.

62. Cone or Speed Pulleys are employed where a limited change in the rate of motion (number of revolutions per minute) of two shafts is required. Figs. 115, 116, Plate XII., represent an arrangement of speed pulleys; S_1 and S_2 are the two shafts, on each of which are fixed speed pulleys A and B respectively. Each pulley is made up of three pulleys or *speeds*, *b*, *c*, *d*, of different diameters, increasing in radii by a common quantity *a*. The pulleys are arranged as shown in the figures, so that the smallest speed of the set on A is connected with the largest of the set on B; and as the diameters *b*, *c*, *d* of the pulleys A and B are equal, the length of the belt is constant for each of the three positions in which it may be placed when connecting the speeds *b—d*, *c—c*, *d—b*. Let A be the driver, then when the belt is in the position shown (on *b—d*), S_1 rotates a greater number of times in a given time (a minute) than S_2; when the belt is on *c—c*, S_1 and S_2 rotate the same number of times per minute; and when the belt is on *d—b*, S_1

rotates a less number of times per minute than S_2. By increasing the number of speeds a greater amount of variation can be obtained; however, it is not usual to employ more than six speeds.

63. The common quantity a is termed the *fall* or *step;* if the diameter of the smallest pulley $= b$, then the diameter of $c = b + 2a$, and the diameter of $d = c + 2a$; thus, let the diameter of $b = 12''$, and $a = 1\frac{1}{2}''$, then the diameter of $c = 12'' + 3'' = 15''$, and of $d = 15'' + 3'' = 18''$.

The *sums* of the diameters of the two connected pulleys are constant, thus $b + d = 12'' + 18'' = 30''$, $c + c = 15'' + 15'' = 30''$, and $d + b = 18'' + 12'' = 30''$. The arrangement is independent of the distance between the axes e. Speed pulleys are employed in a variety of machines, of which perhaps the most common is the lathe.

64. Figs. 117-119, Plate XII., are elevations of a speed pulley; the fall is $1\frac{1}{4}''$, and the diameters of the speeds are $1'..5''$, $1'..2\frac{1}{2}''$, and $1'..0''$. In this example the pulley is fixed on the end of a shaft a, one of the bearings of which is marked e, fig. 119. Fig. 117 is an end-elevation of fig. 119 projected in the direction D. Fig. 118 is an end-elevation of fig. 119 projected in the direction E; the top half of this figure shows the inside of the pulley, the plate f having been removed; the bottom half shows the plate in position. The greater portion of fig. 119 is in section, portion of the shaft is also in section showing the mode of connection between the pulley and shaft. The plate f is connected to the pulley by means of three screws g, one of which is shown in figs. 118, 119; in the top half of fig. 118 are shown the two holes g_1, to receive the screws g: this plate is provided with a boss h, which is *bored out* to the same diameter as the shaft upon which it runs loose. k is the boss of the pulley; the connection between the shaft and pulley is made by means of a key let into this boss and the shaft; l is a washer fixed to the shaft by means of a set-screw o, its use is to prevent the pulley from working loose on the shaft. The following are the remaining dimensions:—Width of each speed $3''$; boss k $4\frac{5}{8}''$ diameter $\times$ $3\frac{1}{2}''$ through; boss h $4''$ diameter $\times$ $3''$ through; diameter of the shaft a $2\frac{1}{2}''$; thickness of metal at f $\frac{7}{16}''$, at m $\frac{5}{16}''$, and at n $\frac{7}{16}''$; diameter of set-screw o $\frac{3}{4}''$; diameter of set-screws g $\frac{1}{2}''$; washer l $3\frac{1}{2}''$ diameter $\times$ $\frac{3}{8}''$ thick; key $\frac{1}{2}''$ square and $3\frac{1}{2}''$ long. The whole is of cast-iron except the shaft a, the screws g and o, and the washer l, which are of wrought-iron, and the key, which is of steel. The outer surface of the speeds is curved as shown at pq, the amount of convexity is that stated in Art. 59, page 48.

The drawing of these figures should present no difficulty to the student, as there are no lines to be drawn other than straight ones, circles, and arcs of circles; and they should be drawn to a scale of not less than $\frac{1}{4}$. *In all cases the student should work from the written dimensions when given,* rather than apply a scale to the figures, or copy off the dimensions by means of instruments. This remark applies to all the figures in this book, and generally in all cases.

65. On the Teeth of Wheels.—In chapter VII. we considered spur and bevel wheels, without respect to the form of the teeth; we shall now proceed to state the proportions of the teeth of such wheels, and certain practical methods of drawing them, leaving the consideration of the various curves used in their construction for our Advanced Work. In Art. 47, page 41, it is stated why teeth are necessary for wheels, and in Arts. 48 and 49, page 42, we worked out an example of a pair of spur wheels in outline; we will now complete the example for the wheel A showing the teeth.

66. Before working out this example, we will give the proportions of the several parts of the teeth. It is usual

Another set of proportions is obtained by dividing the pitch into 15 equal parts, as shown in fig. 122, and making $T = \frac{5\frac{1}{2}}{15}$, $B = \frac{6\frac{1}{2}}{15}$, $W = \frac{7}{15}$, and $S = \frac{8}{15}$. There are other proportions used by different makers, which come very near to one or other of the above sets. The *form* of the tooth (*efg*, fig. 120) is of considerable importance; there are three chief forms in use; in the examples in this book we shall use the *cycloidal* form of tooth.

67. In figs. 123, 124, Plate XIII., is shown in elevation and plan the spur wheel of 24 teeth and $\frac{3}{4}''$ pitch, whose dimensions are given in Art. 49, page 42. We have substituted arcs of circles for the *epicycloids* and *hypocycloids* which form the curved surfaces of the teeth, as is usual in scale drawings; however, in making the wheels, the form of the teeth should be obtained correctly, and then approximations may be used for drawing purposes. The approximations employed in this example are very near the true form.

Having drawn the centre lines *ex*, *fy*, the pitch circle SP, and the circles for the top and the bottom of the teeth, divide the pitch circle into 24 equal parts; take one of the pitch points, as a, and mark on each side of it a distance $ab = \frac{1}{2}$ W; from d as a centre with a radius db ($=$ the pitch $+ \frac{1}{2}$ W) describe the top of the tooth bb; and from c as a centre with a radius cb ($=$ the pitch $- \frac{1}{2}$ W) describe the bottom of the tooth bb' (the points d and c are the centres of the teeth on each side of a). Then bbb' is one side of a tooth; by repeating the operation its other side can be drawn, and in like manner the remaining teeth of the wheel. The student will find it better first to draw all the tops and then the bottoms of the teeth, so that only one alteration of his drawing instrument will be necessary. Fig. 123 is an elevation, and fig. 124 is a plan, of the wheel; the right-hand half of the plan is in section, as made by a plane S_1P_1, fig. 123, showing the key in position; the other half of the plan is an ordinary projection showing the teeth; the construction lines indicate how each is obtained. The top of the tooth is sometimes termed the *face*, and sometimes the *addendum*, while the bottom of the tooth is called the *flank*.

68. To facilitate the drawing of the teeth of wheels formed by cycloidal curves, an instrument has been designed by Professor Willis, by which arcs of circles are substituted for the curves; the result gives a very near approximation to the true form. The instrument is called by its inventor the *Odontograph;* fig. 125, Plate XIV., is a drawing of it to a scale of $\frac{1}{2}$. For practical use it may be cut out in card-board or sheet metal; the student will be able to construct the instrument from the figure and the following description:—Having provided a rectangular piece of card-board, $13'' \times 7\frac{1}{2}''$, upon one of its edges, as AB, take a point T about $2\frac{1}{2}''$ from B; on each side of T set off distances of $\frac{1}{2}''$; divide each of these into 10 equal parts, and number them as shown; from T draw TC so that the angle BTC contains 75°. The tables are to be copied from the figure; the top one contains the centres for the flanks, and the bottom one those for the faces of the teeth; the first column in each table contains a list of certain wheels of from 13 to 150 teeth; the whole of the wheels are not given, because the error in taking

(*To be continued.*)

Health and Home.

NOTES IN REGARD TO DIET.

A correspondent of the New York *Sun*, in a letter defending an exclusively vegetable diet, in support of his views, says that in Dr. Hall's *Journal of Health*, a few years ago, the following statement of the amount of nutriment in various articles of food was given :

"Raw apples, 10 per cent ; boiled beans, 87 ; roasted beef, 20 ; baked bread, 80 ; butter, 96 ; boiled cabbage, 7 ; raw cucumbers, 2 ; boiled fish, 20 ; fresh milk, 7 ; roasted mutton, 30 ; roasted pork, 24 ; roasted poultry, 27 ; boiled potatoes, 13 ; boiled rice, 88 ; sugar, 96 ; boiled turnips, 4 ; roasted veal, 25 ; and boiled venison, 22."

From this loose statemeut of Dr. Hall he makes the following deductions :

"The cheapest articles of food, except butter, are the most nourishing. A pint of white beans, costing a few cents, contain the same amount of nutriment as 3½ pounds of prime roasting beef, which is twelve times as expensive. Furthermore, a pound of Indian meal will go as far as a pound of fine flour."

We called it a loose statement, and so are all the statements made in various books in regard to the comparative nourishing qualities of various kinds of food, as they are all based on some false premise ; some, for instance, on the percentage of nitrogen in the food, others on the amount of water in it, &c. The result is an erroneous comparison, and the deductions drawn must be false. Thus in the above table, sugar is 96 per cent, and turnips 4 per cent, making 24 pounds of turnips equivalent to 1 pound of sugar ; rice 88 per cent and roasted beef 26, making 1 pound of roasted beef not much more nourishing than 4 ounces of boiled rice. The whole assertion is simply absurd and the table worthless, as every one will maintain who properly attends to the duty of selecting his food judiciously in regard to the wants he feels.

We deliberately call it a duty to be careful in selecting our food ; we even go further, and call it a crime not to feed well, or to be negligent in our selection, eating or drinking things we dislike, or, what is worse than all, eating when we have no appetite, simply because it is time for meals.

The correspondent above referred to closes his article thus : "I remember reading in the *Tribune*, while Horace Greely was editor, that one pound of cracked Southern corn, boiled nine hours, adding water and stirring occasionally, to keep it from burning, would form a glutinous, nutritive mass of nine pounds when cold, and that a person could live and keep healthy on ten cents' worth of corn a week."

To this we remark that very few constitutions can stand a corn diet. In most cases corn has a tendency to sour on the stomach, and by its continued use chronic dyspepsia and premature death result.

Man, and especially civilized man, needs a variety of food. The man who does a great deal of brain work requires different food than the man who only works with his muscles, as the one consumes more nervous material, and the other muscular ; and as different as the chemical composition of the brain and nerves is from that of the muscles, equally different must be the character of the food needed to supply the waste.

A THEORY IN REGARD TO FOOD.

The *Pall Mall Gazette* says : "A German physician has started a new theory with regard to food. He maintains that both the vegetarians and meat-eaters are on the wrong track. Vegetables are not more wholesome than meat, or meat than vegetables, and nothing is gained consuming a compound of both. Whatever nutritive qualities they may possess, he says, are destroyed in great measure, and often entirely, by the process of cooking. All food should be eaten raw. If this practice were adopted, there would be little or no illness among human beings. They would live their apportioned time and simply fade away, like animals in a wild state, from old age. Let those afflicted with gout, rheumatism and indigestion, try for a time the effect of a simple uncooked diet, such as oysters for instance, and they will find all medicines unnecessary, and such a rapid improvement of their health, that they will forswear all cooked articles of food at once and forever. Intemperance would also, it is urged, no longer be the curse of civilized communities. The yearning for drink is caused by the unnatural abstraction from what are termed 'solids' of the aqueous element they contain—uncooked beef, for example,containing from 70% to 80%' and some vegetables even a larger proportion of water. There would be less thirst, and consequently less desire to drink, if our food were consumed in its natural state, without first being subjected to the action of fire. Clothing, our adviser also thinks, is a mistake, but he admits that the world is not yet far enough advanced in civilization to go about undressed. Whatever differences of opinion may exist as to this anti-cooking theory, there cannot be a doubt that in getting rid of the kitchen with all its abuses, including the cook, housekeepers would be spared a vast amount of worry, and probably on this account alone would live to a greater age than at present."

ARE FAT PEOPLE HEALTHY.— Why are fat people always complaining ? asks some one who entertains the popular though erroneous notion that health is synonymous with fat. Fat people complain because they are diseased. Obesity is an abnormal condition of the system, in which the saccharine and oleaginous elements of the food are assimilated to the partial exclusion of the muscle-forming and brain-producing elements. In proof of this, it is only necessary to assert the well-known fact that excessively fat people are never strong, and seldom distinguished for mental powers and activity. Besides they are the easy prey of acute and epidemic diseases, and they are the frequent victims of gout, heart disease and apoplexy.

ALUM.

Alum, familiar to every one as a white, crystalized, astringent saline substance, is what is called a double salt, being composed of the sulphates of alumina and potash, and comes largely from Civita Vecchia, from the alumstones of the mines of Tolta, and from the coal mines of Hurlett and Campsic, near Clasgow, whose shales are rich in alum, and also from the alum slates of Whitby, in Yorkshire, cliffs of which extend for thirty miles along the English coast. These slates and shales are calcined and lixivated, and the "mother liquor," as it is called, allowed to crystalize. The first product is largely colored by iron, and the finer qualities are re-dissolved and crystalized until pure. Alum is chiefly used as a mordant to fix dyes in textile fabrics, owing to its excess of alumina, which has a strong attraction for such tissues. It is also used in tanning leather, is a powerful astringent for arresting hemorrhage and other excessive discharges, and owing to the beauty of its crystals is largely used in crystalizing vases, baskets, grasses, seed vessels, etc. Owing to the large amount of its "water of crystalization," it has been used as a packing for fire-proof safes and vaults, which give out steam for hours in the centre of conflagrations, and repel heat instead of becoming red hot. Its use by bakers to give bread a snowy whiteness and firm consistence can not be too highly reprehended, but it is a useful cement when simply melted for securing the tangs of knives and forks, and lamps, knobs and other glass objects in their sockets.

FRESHLY PAINTED ROOMS.—The impression that those who inhabit rooms freshly painted are in danger of lead poisoning has been shown by Dr. Clement Biddle to be quite unfounded. He bases this statement upon the result of the following experiment: He introduced into a close box a number of sheets of paper saturated with white (lead) paint, and upon the bottom of the box placed a shallow dish of pure (distilled) water, previously tested to make sure of its perfect freedom from impurities, and from lead in particular. After an exposure to the atmosphere of the box for three days, the water-dish was removed, acidulated with nitric acid, and treated with sulphureted hydrogen, when not a trace of lead precipitate occurred. Dr. Biddle therefore attributes the colds and other unpleasant consequences experienced by sleeping in freshly-painted apartments to the irritating action of the vapors of turpentine on the lining membrane of the air-passages.

DANGEROUS HOUSES.—Houses that have been empty may become fever breeders when they come to be reoccupied. An English sanitary officer alleges that he has observed typhoid, diphtheria, or other zymotic affections to rise under these circumstances. The cause is supposed to be in the disuse of cisterns, pipes and drains, the processes of putrefaction going on in the impure air in them, the unobstructed access of this air to the house, while the closure of windows and doors effectually shuts out fresh air. Persons moving from the city to their country homes for the summer, should see that the drains and pipes are in perfect order, tnat the cellar and closets are free from rubbish, and the whole house thoroughly aired before occupying. Carbolic acid used freely in the cellar is a cheap and good disinfectant.