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The Canadian Patent Office
RECORD
AND
MECHANICS' MAGAZINE

Vol. 3. DECEMBER, 1875. No. 12.

EMPLOYERS AND EMPLOYED.

The year 1875—now almost at its close—is one that will be long remembered by both Employers and Employed, as a year of great depression in all sources of mechanical industries, not only in the Dominion of Canada, but in every country where manufactories form the principal source of its peoples' wealth, and give employment to a large proportion of the human race in all parts of the civilized world. For many months past, has this depression existed, and we fear there is little prospect of the early part of the coming year bringing with it any change in the financial state of the country; probably not until the Spring is far advanced and confidence become partially restored. will money again roll on in safer channels of trade and commerce, therefore, until a marked reaction takes place, a great amount of misery will have to be endured by many mechanics, not only in this city, but throughout the whole Dominion; although those residing in country places will not feel it to so great an extent as residents in cities, as they have less burthen to bear in the way of rent and taxes, and have more resources within themselves of supporting their families.

It is hardly within the province of this Magazine to attempt to give reasons for the financial difficulties which have brought about such hard times, but in the chain of circumstances which, link by link, have been increasing, and adding to our embarassments, we cannot but feel that so far as the building interests are concerned a great many links have been added thereto by the Employed themselves, by injudicious and unreasonable endeavours, through strikes, to force from the manufacturers and builders a rate of wages far beyond their power to pay; —upon this cause, therefore, we certainly consider it within our province to dilate.

Some months since, being in New York, and having business with parties connected with the building interests of that city, the complaints we heard were loud and long against the injury done by these continued strikes; but, said one of our informants, it is worse this time than heretofore, for the strike is with the masons, so that if the foundations of a building are not laid and the walls erected, every other branch of the building business must come to a stand. If masons, through a combination, refuse to work, the bricklayer, the plasterer, the carpenter, the carver, the plumber, the painter, the roofer, and in fact, many other trades are brought to a stand still, the circulation of large sums of money arrested, and thousands thrown out of employment, and as is generally the case, through the instrumentality of a few worthless troublesome characters, who have nothing to lose should their advice be followed by their dupes. But the evil done to business and to the families of those who have been forced into these unions, by this stop to the circulation of capital, does not rest merely with those thrown out of employment; the grocers, butchers, bakers and others who supply the mechanic with the necessaries and comforts of life, become also heavy losers, for the mechanic is no longer able to pay them ready money for their goods, and if they trust them, the probability is that in a majority of cases they will be losers, and so it is, my informant went on to say, that, through the bad advice of a few worthless and discontented men, the whole machine has stopped running, because contractors would not undertake to build unless guaranteed a per centage on the mens' wages—and capitalists prefered investing in other projects rather than commence to build a block of houses, which, at the rate of wages when the building would be commenced, might cost $100,000 would, owing to strikes amongst the tradesmen after it had been begun, cost $150,000.

The party or parties who get up these strikes are generally men of a discontented nature, and having a great deal of self-importance, they are fond of loud talking—a sort of declamatory power which is used entirely to unsettle the minds of their fellows workmen. These leaders are generally men who have very little to lose themselves, but have a good deal to do with the distribution of the funds contributed to maintain a lengthened stand-out. They lead them to believe, by dint of uncontradicted assertions and false reasoning, that their employers are coining money from the sweat of the brow of the artizan, and that there is no reason why the employer should receive so much and the employed so little; but the truth is these men are no more competent to form an opinion, much less to be a safe authority on the financial standing of a manufacturing firm than a red Indian from the Prairies. Is it, because sales were large and prices fair, say last year, and the year before, that the manufacturer is to spend his profits in the expectation that they will always so continue, what sort of a business man would he be if when times were good he did not look into the future and lay by sufficient to carry him over the difficulties of a year like the present one, when nearly all his customers are suffering from similar causes and unable to pay him. What would be the result were he though strikes, high wages, and these temporary and ruinous stoppages of the work at his manufactory, be unable to place any profits to his credit to meet the exigencies of a commercial crisis? why he would fall under the first blast of the storm, and hundreds of families he thrown out of employment, not for a mere temporary period, but perhaps for a year, and the mechanic would then see the result of following such bad advice, in the source from which he enjoyed a maintenance crumbling-away before his eyes, and all this through following the suggestions of a few discontented and worthless men. What, then, Employed is the almost inevitable results? Misery is inflicted upon a wife and children, sickness, the accompaniment of poverty, soon finds its way into your dwelling and carries off one or more of your beloved ones, and you that once walked out daily from your door to your workshop with a firm an independent step and returned home at night to be cheered with the welcome smile of your wife and the pretty prattling of your little ones, find yourself a broken man, the source from which you derived your living taken away, and you, a dependent upon the cold charity of the world.

There can be no possible doubt in this matter, that the frequent strikes in the manufactories of the United States and in the Dominion also, have been, to a great extent, the cause of many evils from which we are now suffering. The increased cost of labour has raised prices of buildings far beyond their intrinsic value, and every kind of labour and material has increased in a similar ratio—thus it is that mechanics have heavy rents to pay now in a time of distress far beyond their means. Another cause of the evil strikes has been that these increased rates in wages have led to great extravagances in the families of artizans, for in the expectation that these high wages would always continue, they have launched thoughtlessly into unnecessary expenses in a manner far beyond what was needful for their position in life, instead of laying by something for a day of trouble.

And now for a few words of advice to both Employers and Employed. Let the Employed always study the welfare and interests of those he employs, let him not look upon them as if they formed part of the machinery of the establishment, but feel for them a real interest, encouraging the young mechanic to habits of industry and sobriety by kind words and his own example When he finds a workman superior to another in ability, that man considers he is entitled to some increase in his wages over that of another, far inferior to him in skill, let him have it; if the inferior grumbles, let him go. Never abuse your men with harsh words and never approach them with any familiarity, for once a master or a foreman forgets his proper position inside the factory, he has lost his influence, respect and power over those he employs. Put from your employment a discontented man, or a talker, as soon as ever he shows his hand—these are the men who make the strikes, and frequently bring to ruin both the Employer and Employed.

On the other hand let the Employed cherish a desire to do their work cheerfully and uprightly, if they feel they have a grievance represent it in such a way that it will be carefully investigated and remedied, for there are few employers so blind to their own interests, that will part with a really deserving and skillful workman without just cause, or who would not remedy a grievance if brought respectfully before them; but above all give your children a sound practical education, let the foundation be laid on a moral soil, and consist of such firm materials that on it, in years to come, they may through their ability and industry erect with safety the works and machinery of a future fortune.

In concluding the last number of this year's volume most heartly do we tender you our best wishes for more prosperous times, a Merry Christmas, and a Happy New Year.

One of the soda lakes of the Laramie plains presents a crystallisation 5ft. deep over ninety acres of surface.

Mr. C. C. Thomas exhibited at the fair of the San Francisco Mechanics Institute a steam engine which can easily be covered by a thimble. It is of the vertical type, three-quarters of an inch in its greatest height. The cylinder is one-eighth of an inch long and three-sixteenths of an inch stroke. The valve moves one-thirty second of an inch. The engine is made of gold and silver, the working parts, however, being made of steel. The whole thing is set on a California gold dollar, and can be covered with a No. 6 thimble. Mr. Thomas made a little lathe to turn out the different parts of this machine, and every piece is perfect

RECIPROCATING vs. ROTARY ENGINES.

By F. A. Wiswell.

Beebe Plain.

Very many mechanics labour under the erroneous impression that a reciprocating steam engine does not furnish as much power as would a rotary engine, both using the same amount and pressure of steam. Many inventors have spent years of time and study on this very point, supposing, when perfected, they would have a machine of great power with comparatively small expenditure of steam. Unfortunately but too many such are unacquainted with the details of mechanics, and it is only after much hard study that they gradually become aware that there are principles involved that, at first, they were totally ignorant of. Then, when they "read up" on the subject, they discover that so much is required in a rotary engine to successfully compete with the improved styles of reciprocating engines that they usually become discouraged and abandon the project; thus losing much time spent in misdirected study. It is not only of rotary engines that this is the case, but of many other machines; notably, perpetual motion; when had they but known this truism: "*Power cannot be gained except at the expense of time,*" would have prevented useless study in this direction. A short time since, a gentleman came to me, and, in very enthusiastic terms, explained a road metor to be propelled by springs, and on which he desired me to secure Letters Patent for him at once. I asked how long it would take to wind up the springs for an hours journey. "I haven't made any calculations as to that," he replied. When I explained that with a carriage of such weight that it would require his whole strength to move it three miles in one hour, it would also require the same exertion for an hour to wind up a spring that would drive the carriage the same distance in the same time, I am happy to say he abandoned the idea altogether.

A properly constructed reciprocating engine, with appliances for expanding the steam to the most economical point, will develope as much power as is possible to obtain in a rotary, both being of that type called high pressure. That is to say, without taking advantage of atmospheric pressure in either. At first thought, this might seem to those for whom this paper is written, to be incorrect; but I will endeavour to show that my assertion is based on a thorough understanding of the subject.

First, then, it is supposed that a large per-centage of power is lost by the intervention of the crank,—that when at or near the inside and outside centers the pressure of the steam does not exert the maximum of power. To clear up this point, it must be borne in mind that near these points the motion of the piston is slow, while the force of the steam is more sustained than at any other part of the stroke. In other words the quantity of steam used exactly corresponds to the amount of power developed. This is also true of every part of the stroke, for it is evident that when the stroke is half performed the speed of piston is greater than at any other portion, consequently a greater quantity of steam is being used at that portion, while a greater amount of power is being developed. If, however, steam is used expansively— divided from the generator at a certain portion of the stroke, the sum becomes changed somewhat, but not to a disadvantage unless carried to extreme. For instance, suppose the steam to be "cut off" at $\frac{1}{10}$ of the stroke at a pressure of 115 lbs. per square inch (the 15 lbs. bring the atmospheric pressure), it will be understood that when the piston has travelled $\frac{2}{10}$ of the stroke, the steam having expanded to twice its original bulk, the pressure will be reduced one half. To make this easy of comprehension the following table of approximate figures has been prepared:

Point of cut off.	Pressure of steam.	Pressure of air.	Total.	Temperature.
$\frac{1}{10}$	100	15	115	330°
$\frac{2}{10}$	50	$7\frac{1}{2}$	$57\frac{1}{2}$	280°
$\frac{4}{10}$	25	$3\frac{3}{4}$	$28\frac{3}{4}$	220°
$\frac{8}{10}$	$12\frac{1}{2}$	$1\frac{7}{8}$	$14\frac{3}{8}$	210°
$\frac{10}{10}$	10	$1\frac{1}{2}$	$11\frac{1}{2}$	200°

It will be seen from this table that the 10 lbs. pressure of steam is 5 lbs. below atmospheric pressure, while its temperature is several degrees below that necessary to maintain the vaporous state. (*) It is evident, therefore, that a vacuum would be formed on the steam side of the piston. Another disadvantage that arises from the extreme expansion of saturated steam *i e*—steam having a temperature that is simply due to its pressure—is, that when so expanded, and its temperature so much lower than that of the cylinder, heat is abstracted from the latter, which in turn, being cooler than the fresh, high pressure steam, cools it, so that a portion becomes condensed; thus destroying the effective force of that portion. And this is not obviated by jacketing, although the cooling of the cylinder from the outside is prevented in a measure. To prevent the loss of pressure by condensation, steam should be super-heated sufficiently to have a temperature at its greatest expansion nearly, if not quite, that due to its greatest pressure. These, of course, are evils that our indigenous to both types of engines, but such as are successfully overcome in the best reciprocating engines, and such as must be overcome by the rotaries before they can successfully compete with them.

The main object of the compound engines is to use steam expansively without the successive variations of the temperature of the cylinder incident to the expansion of steam in the one cylinder, by using steam direct from the generator the full length of the stroke then exhausting into a longer cylinder, usually about four times the size of the first. Of course there is back pressure in the first cylinder; but it is only one fourth that on the opposite side of the piston, while the greatly increased area of the auxiliary cylinder, it is claimed, gives, combined with the first, a larger amount of power with greater economy of steam than is possible to obtain in one cylinder.

With the successful working of the compound engine in view, it strikes me that it would be mechanically easier to construct the rotary so as to expand the steam in separate compartments, or, perhaps, segments of its circle, than to attempt to "cut off" at a certain, or even variable portion of the stroke as in the Corliss engines.

Having explained the principal difficulties to be overcome by the rotary to make it equal in power and economy to the reciprocating engine, and having shown, too, that it cannot hope to surpass the latter in these respects, the question may be asked: "What is the use, then, of attempting to invent a rotary?" The answer is: "Economy of space; its direct applicability to rotary saws, and such like machinery; cheapness of construction; simplicity; portability, and great speed without the intervention of pullies, belts or cog wheels." These are cogent reasons, I think, why a rotary engine, combining these features would be very desirable; but nothing less than this will satisfy the users of steam power of the present day.

(*) I am aware that John Bourne states in his Catechism of the Steam Engine that "if steam of 100 lbs be expanded down to steam of 15 lbs., it will have 35 degrees of heat over that which is required for the maintenance of the vaporous state, or in other words, it will be surcharged with heat." This is an error which I am confident that gentleman made unwittingly, for I cannot believe he was unaware of the fact that by the expansion of steam its heat was also expanded, and that if compressed again to its original volume, its corresponding temperature would be again assumed. F. A. W.

PREMIATED DESIGN FOR THE GERMAN PARLIAMENT HOUSE.

(See page 356)

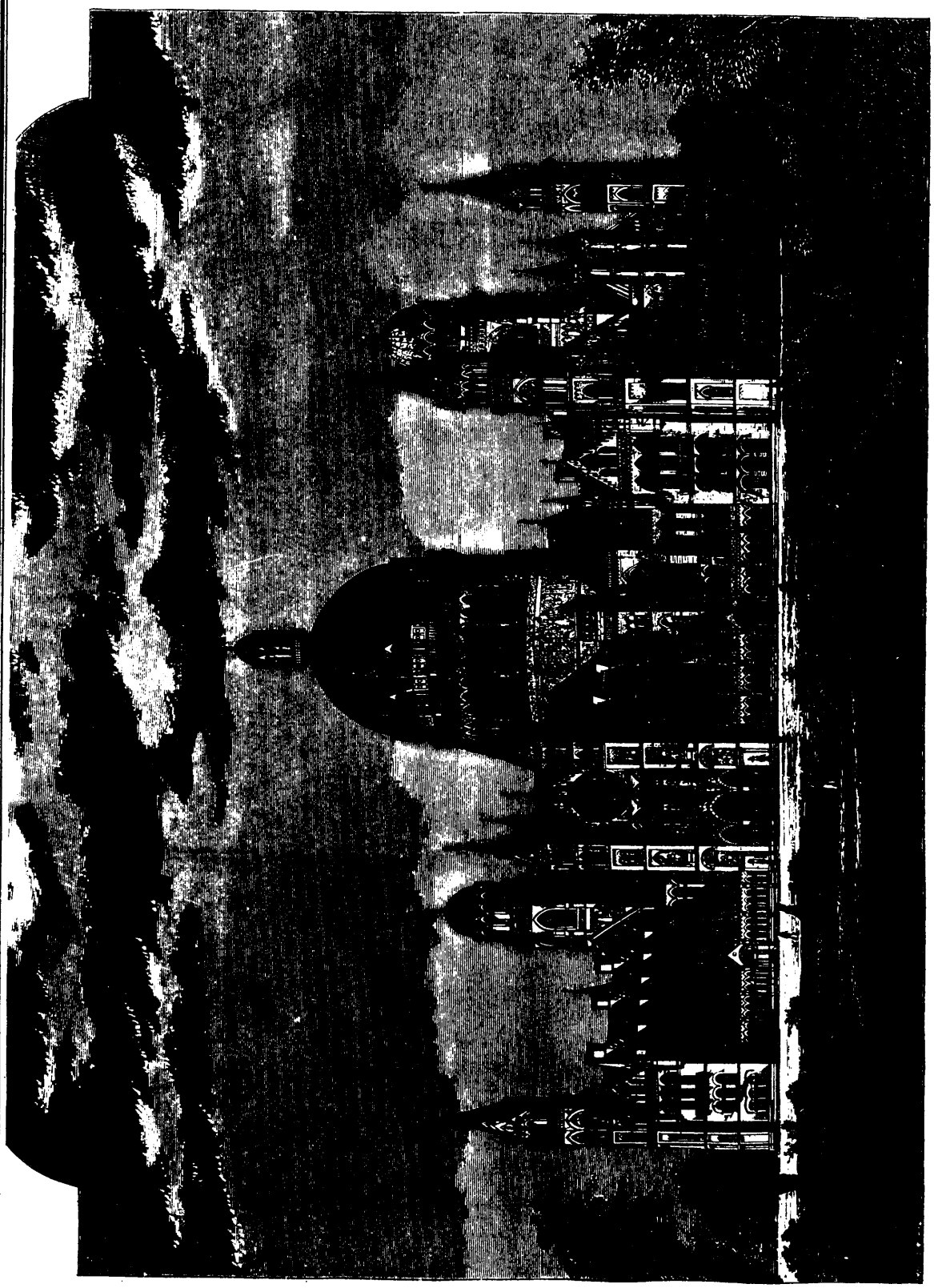
Some time ago the German Government invited designs from architects of all countries for their Parliament House, proposed to be built at Berlin. From a large number sent in, five designs were selected, and received the premiums. One of these was the work of the distinguished architect Sir Gilbert, G. Scott, R. A. The style adopted is that of the thirteenth century, retaining in it those especially German characteristics which may be viewed as more properly belonging to the twelfth, though nevertheless extending themselves far into the thirteenth century, and thus raising and standing by the national banner against the advancing fashion of amalgamation which eventually effected their extinction.

It is reported that another competition, *confined to German Architects*, is to be invited.—*Builder.*

THE BELL-TOWER AT EVESHAM.

(Page 357.)

Our readers may remember that, at the last Congress of the British Archæological Association, held in Evesham, a discussion arose concerning the real date of the bell-tower there, always attributed to Abbot Lichfield, who received that office in the year 1513. The Rev. Mackenzie Walcott, in a paper then read, brought documentary evidence to show that, so far from this being the case, it was built about a century earlier, probably by Abbot Zetten, in which view he was supported by Mr. Parker. The question excited considerable interest, and the architectural members of the Association who happened to be present met on the spot the next morning, and agreed unanimously, on the evidence of the building itself that the ordinary belief was correct. In this we fully agree, and the tower being a noble one, and amongst the latest works in the Gothic style in England, we give



PREMIATED DESIGN FOR THE GERMAN PARLIAMENT HOUSE, PROPOSED TO BE BUILT IN BERLIN.—By Sir G. G. Scott, R.A., in conjunction with his Son, Mr. J. O. Scott.

THE BELL-TOWER AT EVESHAM.—*Sixteenth Century.*

a view of it,* and append some documentary evidence on the subject. Thus, Pindall, the historian of Evesham, says :— †

"Clement Litchfield, before prior, and a man who cannot be mentioned without emotions of pity and reverence, was made abbot of Evesham on December 28, 1513 . . . . Both the learning and virtues of the man were admirable. He was a munificent patron to his convent, and laid out much money in repairing old buildings and erecting new ones. He adorned the choir with much elegance and splendour; *built a very handsome tower on the cemetery, which still remains entire*, and added two chapels of extraordinary beauty, one to St. Lawrence's Church, and the other to All Saints . He continued abbot till near the dissolution; and then, not choosing to surrender his abbey to the king, was, by the vile arts and low devices of Cromwell, obliged to resign his pastoral office to Philip Hawford, *alias* Bellard, a young monk of Evesham, who was, in the year 1539, created abbot, for the sole purpose of surrendering the abbey. Thus he did on November 17, in the same year. The grief and indignation of poor Litchfield, who survived this catastrophe but a short time, may easily be imagined. It may, without exaggeration, be supposed to have broken his heart. He died at, or near, Evesham, and was buried at the entrance into his own chapel, in the church of All Saints, where there is still to be seen a large blue slab, which protected his remains, but of which the inscription is now entirely defaced. The following was put up in his lifetime, in a window of the same church :- 'Orate pro anima Clementis Lychfeld sacerdotis: *cujus tempore turris Eveshamæ ædificata est.*' This inscription also has long disappeared."

Again, speaking of this tower, Tindall says it is one of the finest specimens of architecture "left by our Popish ancestors in the whole kingdom, and is likewise allowed to be one of the latest, if not absolutely the last."

Gough speaks of this tower as "the last building erected by Popery in England"

Habington, who wrote in the time of Charles I., gives the following account of the chapel and tomb of Abbot Lichfield :—

"About the middle of the south aisle (of All Saints' Church) is a curious building called Lichfield's Chapell, in whose embowed chapell is a scutcheon, with the letters of gold, C.P.L.; and on another the lock and chain, ensigns of the Abbey of Evesham. At the entrance of this chapell lyeth humbled on the ground the resemblance of an abbot, truly great in leaving the dignity of his high place; and wise, when foreseeing the storm which overthrew this with other religious houses, he struck sail to avoid shipwrack. His resemblance is engraved at the altar in prayer. On his right hand, "*Deus in nomine tuo salvum me fac.*" On the left, "*Et in virtute tua judica me.*" Below, on one side, "*Quæ in inferno nulla est redemptio.*" On the opposite, "*Miserere mei Deus, et salva me.*" Underneath his feet an inscription, which was also painted on one of the windows :—"*Orate pro anima domini Clementis Litchfield sacerdotis, cujus tempore nova turris Eveshamiensis adificata est.*"

It is only right to say as respects Mr. Walcott's statement that he considers these records applied to the central tower of the Abbey, and not to this. The building itself, however, settles the question. Amongst the obvious indications will be noticed :—1. The general squareness of treatment; 2. The use of the four-centered arch; 3. The dripstones of the archway; and 4. The great similarity to the chapels built by Litchfield attached to the churches of St. Lawrence and All Saints. -*Builder.*

* Our drawing was made a fine photograph, produced by Mr. Earl, of Worcester.

† History and Antiquities of the Abbey and Borough of Evesham. By W. Tindall, M.A. (Evesham, 1794.)

AMERICAN INVENTION.—The great American inventions which have been adopted all over the world are the following :—1. The cotton-gin. 2. The planing machine. 3. The grass-mower and grain-reaper. 4. The rotary printing press. 5. Navigation by steam. 6. The hot air (caloric) engine 7. The sewing machine. 8. The india rubber industry. 9. The machine manufacture of horseshoes. 10. The sand blast (for carving). 11. The gauge lathe. 12. The grain elevator. 13. The artificial manufacture of ice on a large scale. 14. The electro-magnet, and its practical application, by Henry and Morse 15. The composing machine for printers.

FOR LUTE, or cement for closing joints of apparatus, mix Paris plaster with water to a soft paste, and apply it immediately. It bears nearly a red heat. To render it impervious, rub it over with wax and oil.

AN IMPROVED CHUCK FOR HOLDING DRILLS AND TOOLS.

(See page 384.)

An improved chuck for holding drills and tools for use in the lathe or other machines used for boring and perforating metals has been recently patented in this country by W. R. Lake on behalf of the inventor, Frank Armstrong, of Bridgeport, Conn., (U. S.) The new chuck presents certain features that are common to many of the American importations; but if we may believe the inventor, it is a considerable improvement on its predecessors In the drawings Fig. 1 represents a longitudinal section of the chuck fitted on a lathe spindle I; Fig. 2 is a front view; Fig. 3 shows interior of front shell; Fig. 4 interior of rear shell; and Fig. 5 shows a clamping jaw detached. Similar letters indicate the same parts throughout the drawings A, the front shell, is cut away as shown in dotted lines in Fig. 2, to form openings for the introduction of the jaws C, which are of the shape shown in Figs. 1 and 5, or of any other suitable shape; the recesses (1) of these jaws take a bearing on corresponding shoulders in the shell A, whereby they are held against longitudinal thrust or pressure. The jaws C, extend rearward to and rest against the face of the central bevel gear wheel E, as seen in Fig. 1. The front shell A has a projection or hub which is accurately fitted to the rear shell B, so as to hold the jaws firmly, and at the same time prevent the ingress of chips, dust, or other matter which would interfere with the proper working of the chuck. Suitable recesses are formed in the shell A to permit the introduction of the pinions P, and of the bushing-nuts shown at the upper part of Fig. 1. The pinions are formed with a hollow shank, fitting closely, but capable of freely rotating in the bushing nuts. Their outer ends are squared to receive a key or wrench whereby the pinions may be turned to adjust the jaws; washers or friction plates, having extensions or ears to prevent them from turning, are placed on the shanks of the pinion P in such a position as to take the friction of the pinions from the bushes, and thus prevent the turning backward of the latter by such friction after the adjustment of the jaws. The pinions P are formed with a female thread fitted to the thread of the screws seen in Figs. 1, 3, which, by rotation of the pinions, cause the jaws C to approach or recede from the centre of the chuck.

The pinions are held in position between the washers and square faces on the hub. The rear shell B is cut to correspond with the shell A to embrace the bushes properly, and is also suitably cut away to receive the bevel driving gear wheel E. The hollow shank or stem F, of this gear wheel E, extends centrally through the rear shell, being bored slightly taper to receive the taper end of the spindle I of a lathe or other machine. The rear end of this stem or shank F is fitted with a screw-ring, or nut G, and an intermediate ring or washer H to hold the main gear wheel securely in its proper position. When this nut G is turned "hard up" against the ring H it so tightly clamps the gear wheel E to the rear shell, that the chuck may be reversed to withdraw a boring tool without affecting the pinions or loosening the grasp of the jaws C.

The front shell A and rear shell B are secured to each other in their proper relative positions by screws K, or by other suitable means. It will be seen, by reference to Fig. 1, that, when the parts of the chuck are secured together, the inner ends of the jaws C rest against and are braced by the front face of the bevel gear wheel E longitudinally, and that they are otherwise firmly held within the shell A: it will also be seen that the inner ends of the jaws C and the hub lie in the same plane, and that the whole face of the driving gear wheel E is covered by them, so that no chips or other matter can reach the teeth and interfere with their operation. It will also be observed that the bushing-nuts afford the means of setting up the pinions to compensate for any wear, and any one of the jaws C may be independently adjusted.

When the lathe spindle I is turned in either direction the bevel gear wheel E, rotates with it; and as this wheel is geared with all the pinions P, which cannot change their positions in the chuck, it is obvious that, by holding the chuck and turning the lathe in the proper direction, the screw thread within the pinions, acting on the screws of the jaws, must force them towards the centre of the chuck. The jaws will be thereby adjusted accurately to grasp the tool or a piece of metal to be turned or bored, and the continued rotation of the chuck will tend to tighten it upon the said tool or piece which has by the same operation been perfectly "centred." The reverse movement of the lathe spindle will obviously separate the jaws and release the tool, except when the nut G is held fast as above

described, in which case the tool or piece may be removed without loosening the jaws.

The patentee claims the details as above described separately, in combination with one another, and the whole combination itself, forming a chuck which should consequently be named the *ne plus ultra.—English Mechanic.*

ANOTHER LATHE CHUCK FOR HOLDING DRILLS.

From the English Mechanic.

(See page 384.)

I send sketch, if you think it worth insertion, of a cheap lathe chuck for holding drills or brace-bits which admits of easily setting the drills to run perfectly true, and which need not cost a couple of shillings. I made it when a child, some forty years ago, and have often since proved its value. The chuck is made of hard wood.

Fig. 1, side view.—*a*, wood screw for screwing into the lathe mandril; *b*, square fitting lathe chuck spanner; *c*, *c*, body of chuck of sufficient diameter to cover the heads of the four wood set screws and prevent accidents to the hands during revolution.

Fig. 2, front view.—*d*, iron plate, ⅛ in. thick, let into face of chuck, and then drilled out and filed square to fit the drill shanks, &c.; this plate is secured by two long wood screws, *g*, *g*; *f*, the drill.

Figs. 3 and 4. — Sections through set screws; *e*, *e*, four stiff wood screws screwed into the body of the chuck, with their points entering the central hollow and bearing against the square end of the drill. By altering these with the screw-driver the point of the drill is made to run *perfectly true*.

ARTIFICIAL LEATHER OR CLOTH.

WHILE many inventors have sought to discover a substitute for leather, and have succeeded only to such extent as is represented by American leather cloth, others have endeavoured to utilise the waste cuttings of leather and from them form a material which is only so far leather that it is made from that substance. Unfortunately but very indifferent success has hitherto attended the attempts to utilise the cuttings, which, though not exactly waste materials, are little better. Recently in our "Scientific News" we alluded to a new article which under the name of "cuir-liège," or leather-cork, was attracting some attention at the Maritime Exhibition in Paris. It appears that Mr. G. E. Block, of Marylebone-road, London, turning his attention in a different direction to that taken by the inventors of American cloth, and discarding the scraps and refuse leather, has succeeded in manufacturing a compound of cork and india-rubber, which while possessing many of the useful qualities of leather, is superior for many of the chief purposes to which it is applied. The invention, which is patented, is called an improvement in the manufacture of artificial leather or cloth; but seeing that cork is the substratum, the term leather-cork or cuir-liège is a better name for the new fabric. The modus operandi is, simple sheets of thin cork are painted over with a solution of india-rubber on one side, and when the coating has dried a second is applied over the first. A piece of "japanned cloth," canvas, thin leather, or other material possessing similar qualities, is then dressed with two coats of the india-rubber solution on one side, and the cooled surfaces of the fabric and the cloth are then pressed together. The uncoated surface of the cork is now dressed with two applications of the india-rubber solution, and a piece of linen, cotton, or other fabric is similarly treated. When the solution on the cork and the piece of fabric is quite dry, the two surfaces are brought together, and the compound sheet is submitted to great pressure between rollers, under a stamper, or in a press. The inventor says that in order to insure the coated surfaces of the fabric and cork adhering-closely and firmly to one another he finds it better to apply the pressure suddenly, as by a blow such as would be given by a stamper. The two coatings of cementing solution thus brought together blend and form a perfect skin, which is found to possess the maximum of flexibility and resilience—bending and turning in any direction, and yet resuming its normal state without breaking. The coats of solution being permitted to dry before the parts are cemented together, the solution, it is found, does not penetrate the outer surfaces of the material, which thus retains its ordinary appearance.

The artificial leather-cloth or "leather-cork," thus prepared, can be made into boot, harness, bags, portmanteaus, and various other articles. It is also said to be suitable for belts for machinery. In manufacturing this material the sheets of cork must be laid with their edges fitted neatly together, as a gap between the two pieces of the cork may possibly produce a weak spot in the finished fabric, which will materially reduce the "life" of the sheet in which it occurs. From the fact of leather-cork being flexible, as well as light and waterproof, it would seem to be well adapted for tents and awnings, for gig aprons and similar purposes. As mentioned in the "Scientific News" paragraph on p. 64, it is well adapted for buckets, as owing to its flexible nature those useful vessels may thus be stored in large numbers in a comparatively small space. It is also suggested that, by attaching wooden veneers to its surface, it may be ornamented in any desired style, and be used as panels for carriages, &c. Other uses will doubtless be found for material which promises to be widely adopted as it becomes better known. The fabric is said to be unaffected by any ordinary degree of heat, and to be remarkably strong. It met with considerable attention from the visitors to the Maritime Exhibition, and though not yet on sale in this country, will undoubtedly form the subject of numerous experiments when its manufacture is established.—*Scientific American.*

FILES AND FILING.

(See page 384.)

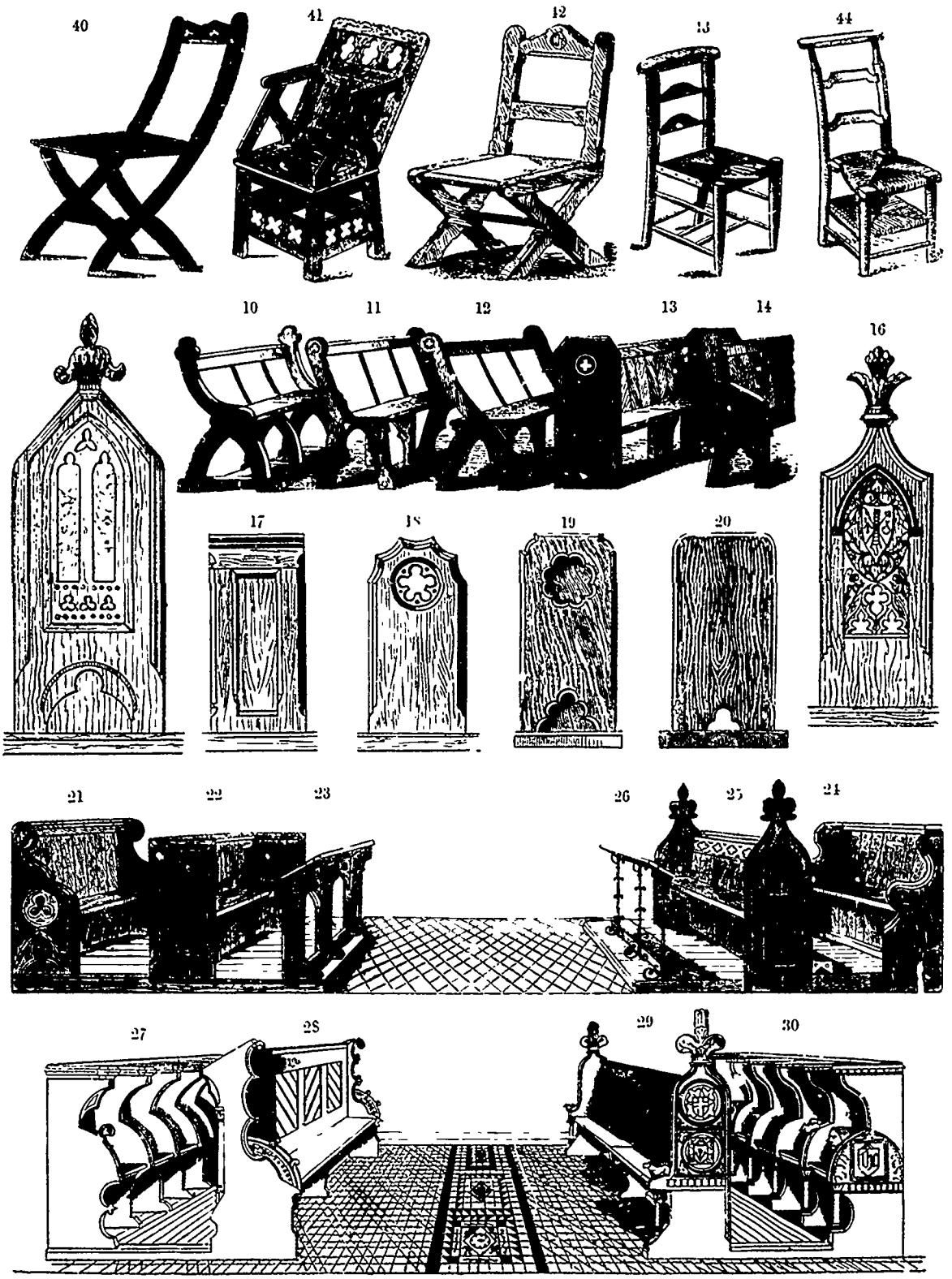
As the file is a tool of universal use among many classes of mechanics, and more especially those who work in iron, it may be well to give a few hints to those who are not throughly initiated in its use. Of the diversity of files and their adaptability to different processes we will say nothing, supposing that to be sufficiently understood.

The work to be filed should be elevated in the vice, or fastened by some means of a height a little below the elbow, as the operator stands erect. The reason of this is obvious. As the file-handle is grasped in the right hand and the point of the file in the left hand, the arms may hang in a more natural position, and as the file is thrust forward and brought back for a repetition of the thrust, the movement is made in a horizontal line with greater facility than if the elbows were required to be raised to make the stroke of the file in the line parallel with the line of the work. The file has not the guide principle, as the carpenter's plane has, and the movement of the file must be accomplished by the position and movement of the elbow. The most natural movement of the hand and elbow are in circular lines, the joints of the limbs being the centre of motion, but in filing a flat surface the hands must be trained to move in right lines.

The mechanic should select good well-proportioned handles for his files; disdain everything that pretends to be "fancy." Handles are best made of well-seasoned maple with strong brass or iron ferrules. The file shank ought to be inserted into the handle in which it is held nearly the entire length of the shank. The handles as purchased are usually bored with a hole for the reception of the file shank, but when they are not so bored the mechanic is necessitated to do it himself. If a small gimblet or bit be used to bore with, it is essential to observe that it enters the handle at the exact centre of the circumference of the ferrule, and that the hole is kept true and central in the handle as the bit advances. This can be ascertained by letting the handle turn in the hand as the boring progresses, the hold of the bit upon the wood being sufficient to admit of its so doing. As the file shank is made of a taper form, it is quite necessary that the hole in the handle be made to correspond, and a taper reamer will form it accurate enough to receive the shank. Do not let a file shank be inserted in the handle up to the shoulder of the file, for it will soon become loose, and the shank will no longer *wedge* into the wood; but if a space of about one-half or three-fourths of an inch be between the handle and the file shoulders, no immediate apprehensions of looseness need be anticipated.

Some mechanics heat the shank of an old file, and with it burn into the handle to shape a place for the reception of the file shank, but such a practice betokens a slovenly workman and is very detrimental to the wear of the handle, for by the wood being charred in the process of burning, it is rendered very brittle, and the handle soon splits ith even ordinary usage and must then be thrown away. If the mechanic seeks to retain the split handle, or mends it by inserting a screw or winding it with wire or cord so as to make it subservient to his purpose, it has a blotched and unsightly appearance, and is a very unsatisfactory handle after all.

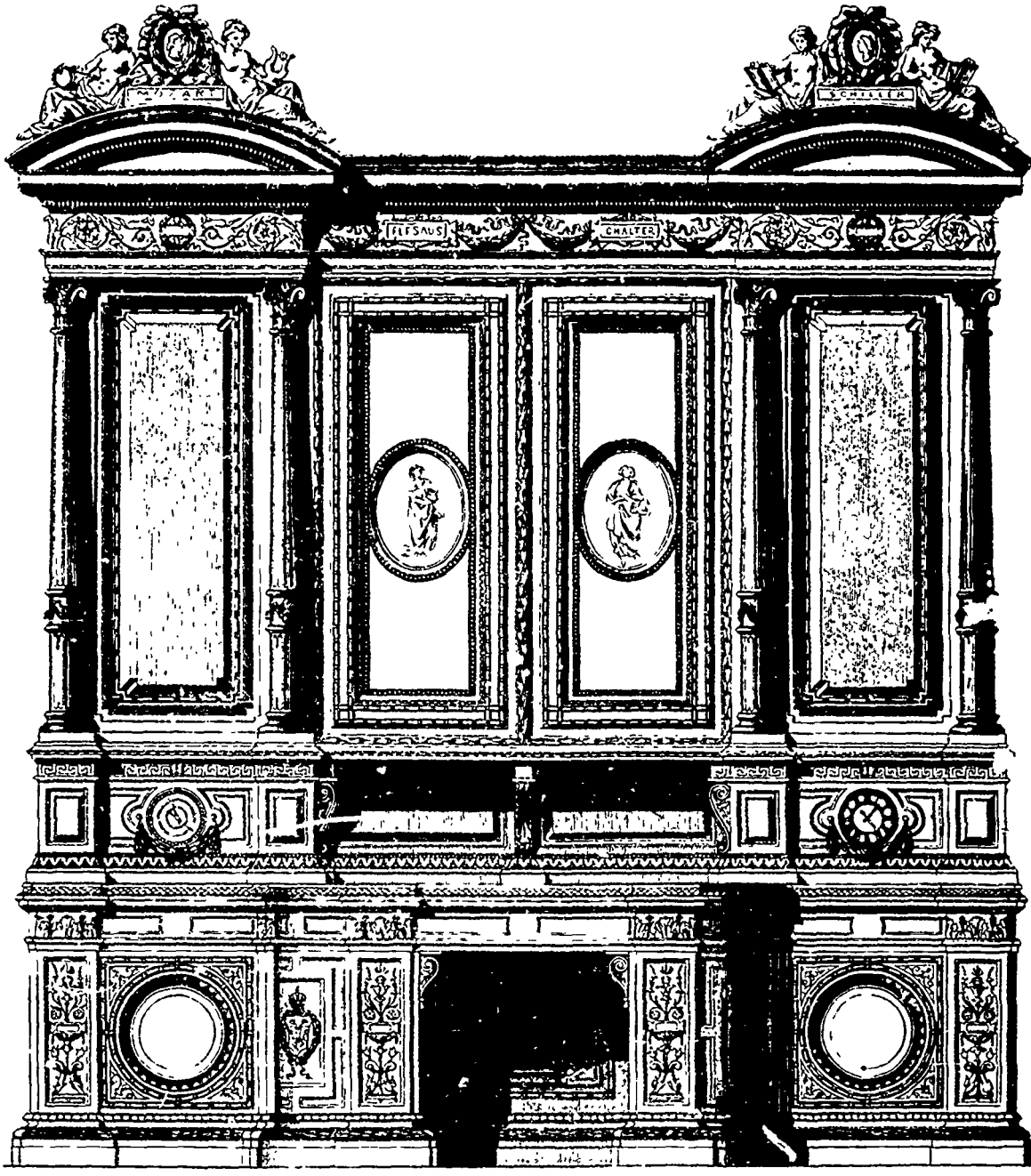
We have seen on a workman's bench two dozen or more files of different sizes, and used for different kinds of work, and with each kind or size of file there was a handle wholly differing from its fellows. We might enumerate that we observed in this lot



GOTHIC CHURCH FURNITURE.

FROM DESIGNS BY MESSRS. COX & CO., OF LONDON.

FROM THE VIENNA EXHIBITION.



DESIGN OF A SIDEBOARD EXHIBITED AT THE VIENNA EXHIBITION.

of files one or two passable handles, one or two chisel handles, two or three which were designed for the awls of shoemakers, some made from pieces of broken broom-stick, as many taken from a rough limb, denuded from its bark, one or two whittled from a pine stick, the product of the pocket-knife of the apprentice, and thrown away by him as useless, and not a new application some of the handles were actually formed of corn-cobs. It might be that a workman would produce as good work with the handles of this character as with well-turned and good-ferruled ones, but when the latter are employed it gives a neater look to the bench; and certainly the workman will operate as expeditiously and as well with *good* tool appliances as with poor ones. If the expert or apprentice would cultivate a disposition for neatness and exactness in his work, he may begin with his tools and appliances, and his file and other handles are very good things to commence with.

If a file-handle becomes split or broken, throw it aside and replace it with another. Do not use pieces of a broom-handle, or but of small limbs denuded of their bark, as we often see done; files *hatchel* up in this way have a sorry appearance and give the look of a "slouchy" workman. Use handles appropriate and proportioned to the tools for which they are intended, take time and care to fit them properly, and experience will testify that they will give better results and last longer, proving that "haste makes waste" even in the small matter of fitting a file handle.

Learn to keep your filing-vice clean, and files in a neat row beside the vice according to their respective sizes. When you begin to use a set of new files, mark one side of them with white chalk, reserving the chalked side to finish any nice piece of work with where a sharp file is wanted. Always have a set of files for the different kinds of metals you work upon. When files do not cut brass with facility they may then be employed to cut cast iron, wrought iron, and, lastly, steel; but if put upon steel or iron first, they are worthless for cutting brass. The surface-scale of metals, particularly cast iron, should be removed before a good file is put upon it, as this scale will instantly destroy the cutting-edge of the file-teeth. It is equally injurious to files to admit of pressure on the file when it is being drawn back for the forward thrust; good filers always raise the file from contact with the work when they draw it back, and lay it gently upon the surface to insure the correct position, and then apply the needful force to make the cutting-thrust.

In the finishing of the bright-work of tools and machinery two methods of filing are employed polishing and draw-filing. The former method was at one time very prevalent, but of late years, especially upon heavy machinery, has been discarded, and a finish by the latter method adopted. To the uninitiated and ignorant the glare produced by polishing is paramount as a finish, but the educated mechanic views it with as much disdain as the enlightened mind regards the sham baubles that please the eye of an aborigine. Polishing, as compared with the process of draw filing, is a cheap method of finishing up tools and machinery, and as a general thing it is only the cheaper class of machine-work that is thus finished, and a piece of mechanism which is glistening from the application of polishing-wheels is open to suspicion as work of inferior merit.

Some labor as well as skill is required to produce a well draw-filed surface, while almost any cheap labour will suffice to operate a polishing apparatus. Patience in the former method rewards us with an exterior which is soon learned to be appreciated, and the mechanic who produced it will look upon his work with evident satisfaction. On observing a mechanic at work and seeing him place his file transversely across the piece of metal upon which he is operating, and then grasp it at each end and move it over the surface to be finished, the operation seems very simple and one which any one can perform; but let the tyro try to do it, and he will find that the finish which he produces is quite different from what he attempts to accomplish. Instead of the clean, smooth dead surface, containing thousands of minute parallel lines formed by the action of the file-teeth, he will find that his finished surface is full of cross-lines, and marred at frequent intervals by little ragged scratches which he can scarcely account for. To avoid the crossing of these minute lines practice to carry the hands over the work in the same parallel lines is requisite, and to avoid scratches requires a delicacy of touch and feeling not so easily acquired, but which instantly tells the mechanic when any foreign matter or filings remain interposed between the file and the work, and which if not removed produce injury that will take some time to eradicate.

To the educated mechanical eye there is no finer finish than that of draw-filing. Small tools and machinery, like sewing-machines and jewellers' tools it may be advisable to polish, but for larger work, such as lathes and engines, the file finish is far preferable.

Draw-filing is done by holding the file in a transverse line with the work, and then drawing it back and forth over the surface to be operated upon. Work finished in this way has a very neat finish and appearance. To clean the files when clogged with the *debris* of the work, use a wire brush or a thin piece of sheet brass which may be drawn through the cut of the teeth, and it will effectually clean them, a better instrument is a piece of cotton card fastened to a piece of wood, and drawn across the file in the direction of the teeth, the hook-form of card teeth forming a ready means of cleaning the file of the dirt and filings. The files used by wood-workers may be cleaned in the same manner

Filing a Flat Surface.

The proof of a good filer is his ability to file a flat surface perfectly true; and in this, simple as the operation may seem, there are but few adepts. It would seem at first thought that a file made perfectly straight and true ought to produce a corresponding true surface, but a file with a perfectly true surface is seldom met with, for by the operation of cutting the teeth and hardening and tempering, all files are apt to spring and warp more or less. It is on this account that the common kinds of files are made with convex faces, and also wider in the middle than at the ends. Granted that files could be made perfectly true, as in the using of them there is no guiding principle, nothing except skill to direct the muscular action of limbs that move in arcs of circles, another great difficulty presents itself, yet by patient perseverance a pretty true surface may be obtained. The best instruction to be given is to lay the file lightly on the surface of the work, concentrate the mind on the object to be attained, and then with a slow and steady force move the file in a right line, as near as possible coinciding with that the file occupied before it was moved over the surface of the metal, avoiding a rocking motion. Care and practice are the only guiding requisites to produce a level surface with the file.

Many kinds of work may be partially rotated to compensate for the swaying of the file, by fixing the material to be filed between centres so as to turn easily, and the centres of the watchmaker's lathe present a ready means for this purpose. If we have a spindle which has been nicely turned and finished in the lathe, and through this spindle we wish to make a mortise or key-way, we can commence by drilling several small holes within the prescribed limits of the mortise, and then cut out the intervening metal between the holes with a narrow cold-chisel, then support the spindle between the centres of the lathe, and the mortise can be easily and nicely filed to the desired form and limit.

If it be desired to make a key-way of some length, directly in a line parallel with the axis of the spindle or shaft, the lines to guide the diameter of the mortise may be made thus: place the spindle between the centres of a fixed-lathe in the same manner as when it was turned, and screw up the dead centre so that the work will not rotate easily upon its axis; then place a sharp pointed tool in the tool-post of the lathe, and with the hand wheel attached to the lathe-feed run the point of the tool along the surface of the spindle as far as the intended mortise is to be made; then turn the spindle or shaft between the centres until the tool-point will mark the opposite diameter of the mortise, and run a line parallel with the first line; by turning the spindle a half revolution, and repeating the lines on the side presented to the tool-point, the outline of the opposite side of the mortise is made.

There are many kinds of work in this metal that it is necessary to nicely finish up; metal patterns for foundry use may be mentioned as an example, and, often being thin and delicate, will not admit of being inserted in the vice to be held for manipulation. These may be operated as follows: Fit a board or piece of hard wood in the lathe in such a way that the line of the centres will be in the same plane with the surface of the board. This can be done by nailing two cleats upon the ends of the board, the centres finding a bearing in the cleats; then fasten the work to this board by means of small nails, and as the file is applied it will oscillate sufficiently to present its surface properly to the surface of the file, and by having the centres upon which the board hangs on a line with the surface of the work upon which the file is engaged the work will have no tendency to rotate by the applied force of the file.

The methods by which the work can be held to this tool for manipulation are various. Clamps similar to those shown in Fig 4 may be applied, or holes may be made in various positions, and the work can be held by the heads of screws which fit into these holes, or if the work be very thin, as sheet-brass, iron, or

steel, small tacks may be driven into the wood at suitable distances around the surface of the work, but in contact so as to retain it in place.

The usual method of holding forms of sheet-metal, such as patterns for various articles or the articles themselves, is to place a block of wood or a piece of plank between the jaws of the vice, and upon the smooth upper surface of this block insert a number of pieces of wire, or even small nails, which shall so hold or retain the work that it may be operated upon by the files or polishing implements, as is required. When the articles are small, and there is a quantity of them, it will pay, perhaps, to fit up a wooden block; yet, even when so fitted, it is by no means a perfect method of holding work. Where the articles to be wrought upon are large and of various shapes and characters, and especially if they are very thin, it takes some time to arrange and fasten them upon the wooden block.

The cut represents a tool designed to hold work of this character. It is made of cast-iron, and when viewed from one of its ends it is of a T-form, and its length or size is proportionate to its intended use. The lower or vertical portion is intended to be held between the jaws of the vice, and the flat surface of the upper part is nicely and evenly planed to receive the work when placed upon it. Two stout straps, made of iron or steel, are fitted to slide upon the projecting sides, and can be confined in any place upon the flat surface of the tool by means of set screws, which are inserted at the under side of the implement at each end of the sliding strap. If it be so desired, these straps, upon the side where they come in contact with the plate, can have teeth cut upon them similar to the teeth of a file, and they will then hold the work very secure; but for finished work smooth straps must be used, as these teeth would indent the surface and mar the finish of the work. It might be well, perhaps, to have two sets of these straps. If the surface of the tool be left a little rough, as the tool of the planer would leave it, and as the line of the cut runs longitudinally, it will assist materially to hold the work in place.

When the work to be operated upon is confined at each end, the middle portion of it is left free for manipulation, and when that portion is finished, one of the straps can be moved to clasp this portion, and the unfinished part can then be wrought upon; and when that is finished, the strap can be moved to its former place, and the other strap moved and the remaining portion of the work finished in like manner.

A modification of this tool can be adjusted to the drill press where a series or a great number of holes are to be made in irregular forms of sheet-metal, and it is necessary that the operator use both hands, as would be the case if it were a plate of steel, the workman feeding the drill with one hand and supplying oil with the other. If it be desired to turn or otherwise work sheet-metal, this tool can be easily held or confined by means of an eccentric or independent jawed chuck, having either two or four jaws, so that it will revolve, and its position or the position of the work can be so changed that any part can be reached with the turning tool, or whatever tool may be brought to bear upon it, as in the case of an ornamental pattern with bosses, swells, or other forms to be turned or finished. If the work be a pattern which is to be chased or engraved, this tool presents a ready means of holding it for that purpose.

It is also a very convenient as well as useful tool to hold their plates or work made of their material that are to be polished or finished with a buff-stick, or by means of emery paper which may be wrapped around a file for that purpose. It is almost needless to add that, when this tool is made of iron or other metal, the upper surface where the work is confined must be planed and finished quite true and even.

If the work be of such a nature as to demand it, or it be of such form that other than a plane surface is required, a piece of hard wood can be fastened to the upper surface of the tool by means of screws, and it can then be shaped to fit and receive the work. Pieces of metal of different forms can be also attached in the same manner. Sometimes soft metal, as type metal, or lead, can be moulded to fit the work, and these castings can be attached to the tool by screws or by the clamps in the same way that work is held.

There is much need of a tool to be used by the filer and pattern-maker which will operate upon the principle of the lathe-centres in the operations we have just described. It might be made like a short lathe-bed of about 2ft. in length, with two heads similar to the sliding head of a lathe, each head to be fitted with steel centres similar to lathe-centres. The work then could be inserted in it in the same manner as we have described in the lathe. If it be desired to file the edge of flat surface at an angle, the work can be fastened to a metal plate or a piece of board and elevated to the desired angle, and will be in a ready position for the easy use of the file. In centring a piece of work preparatory to turning it in the lathe, it is the common practice to confine the work in the vice, mark the centre as near as possible, judging by the eye, and then insert the work in the lathe, and by revolving it with the hand ascertain to which side the centre mark must be moved. It necessarily happens that much time is lost by the workman going from the vice to the lathe and returning, and many times the lathe is wanted for other purposes while the workman is trying the centring of his work in it. But, with the tool we have mentioned to stand beside his vice, he can centre work at his leisure and get it nicely true and ready for the lathe without trying it in the lathe-centres until it is placed there to be operated upon by the lathe-tools.—From Harrison's *Mechanic's Tool Book*.

COMPRESSED AIR LOCOMOTIVE AT THE ST. GOTHARD TUNNEL.

(See page 364.)

The description for this Locomotive will be given in detail in the January Number.

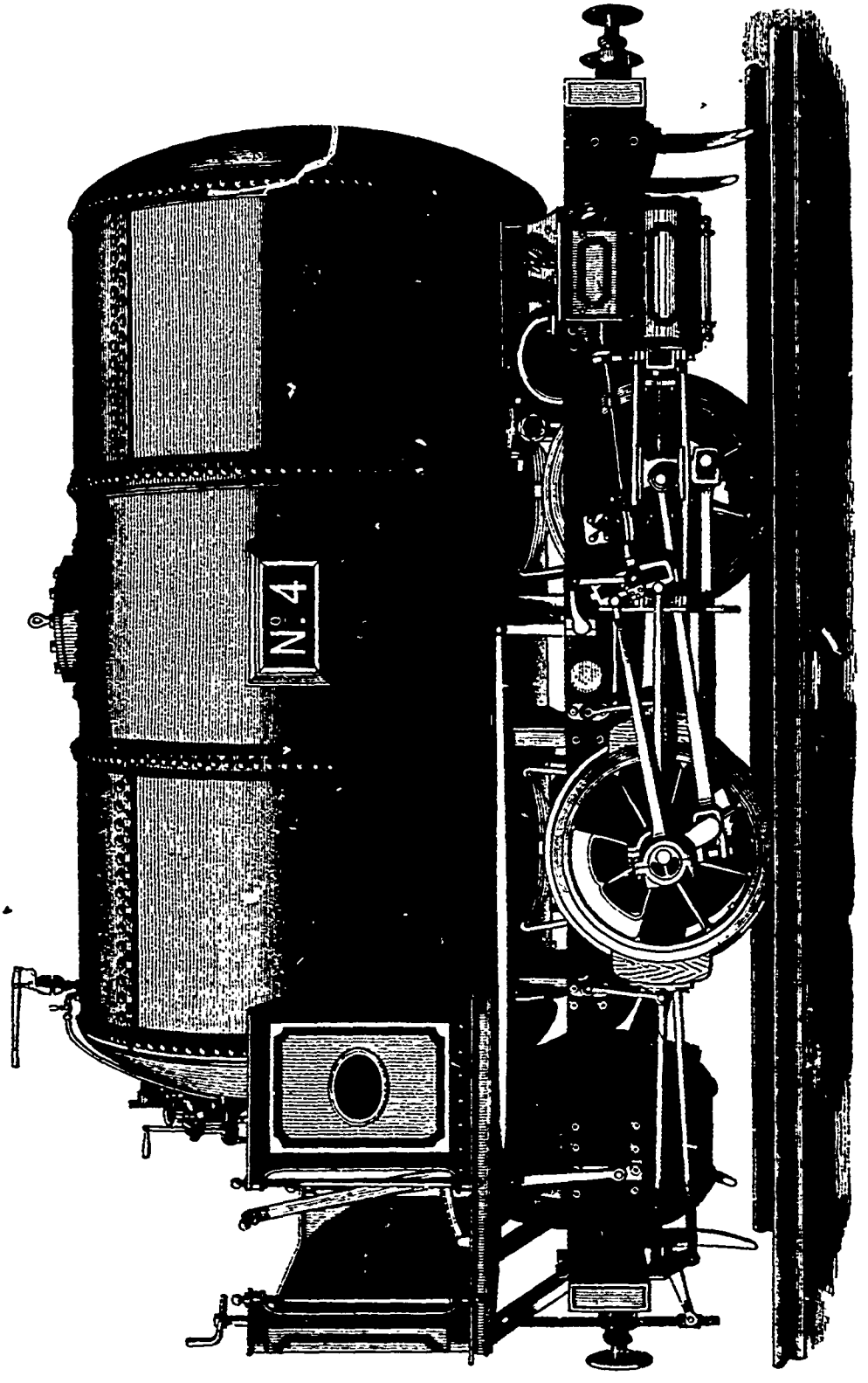
SCIENTIFIC NEWS.

Since the introduction of continuous brakes extraordinary statements are made as to their effectiveness. As a rule, they emanate from persons who know nothing whatever of the action of brakes, but now and then they proceed from people who, rightly or wrongly, are supposed *ex officio* to understand the subject. It was recently stated, during the inquiry into the Kildwick accident, that the driver of the mail had at his command the means of stopping a train going at 50 miles an hour within 400 yards, and the assertion being made by an official it was duly reported, and in certain quarters accepted as a demonstrable fact. Now 50 miles an hour is more than 200 yards in a second, so that to stop in 400 yards would occupy about 30 seconds say, from the application of the brakes, the reduction of speed commencing directly the brakes are applied. Drivers, of course, know that it is utterly impossible, without special appliances, to stop a train, and especially a heavy mail train, in that time—and, consequently, not in that distance - and it seems that Captain Tyler desired to convince the officials of the fact, for he persuaded them to make certain trials a few days ago on the Derby and Trent line, the results of which may be regarded as satisfactory in one sense. Four trials altogether took place, a train being made up to represent as nearly as possible the mail train which took part in the unfortunate accident alluded to. In the first, the speed was just under 50 miles an hour, but with tender-brake, one van-brake, and engine reversed with steam applied, using sand on rails, the time occupied was 54 seconds, and the distance run was 807 yards on the level. In the second experiment, on a gradient, partly rising partly level, the time occupied was 60 seconds, and the distance covered was 843 yards. This was without reversing the engine, but using all other available means. In the third experiment, which took place on a falling gradient (1 in 220), the speed exceeded 52 miles an hour, and all available means were used to stop the train, including reversing the engine and leaving the regulator fully open. The time occupied was 55 seconds, but the distance run was 867 yards. In the fourth trial, on a level line, the speed the same as the third, the time occupied was 50 seconds, and the distance 787 yards, using all available means to stop. Captain Tyler has accordingly pointed out in his report that in the evidence given at the inquiry 800 yards must be substituted for 400; and he also intimates that the driver who is awaiting trial on a charge of manslaughter could not have stopped the train even in 800 yards, for he could not possibly have acted so promptly as those who in the trials were standing ready to obey the word of command the moment it was given. This little episode in the railway world should be a lesson to those in authority who volunteer statements based on nothing better than ideas.

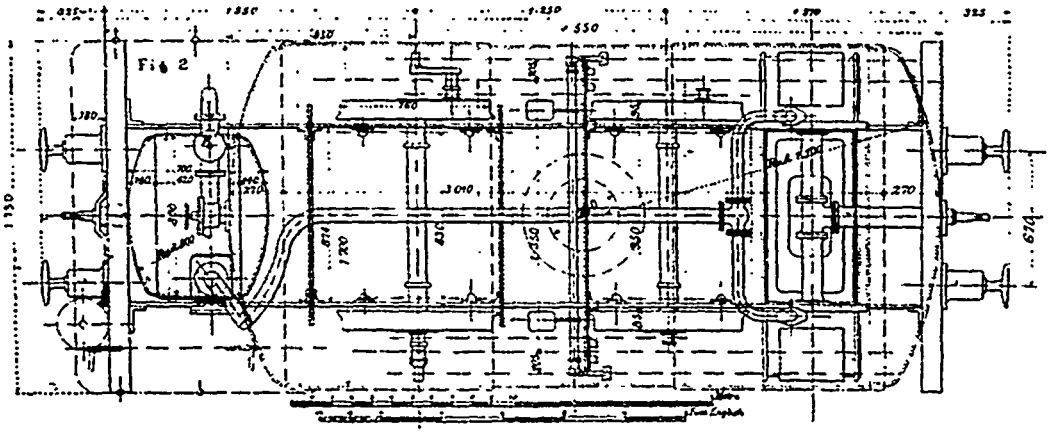
STONEHENGE.

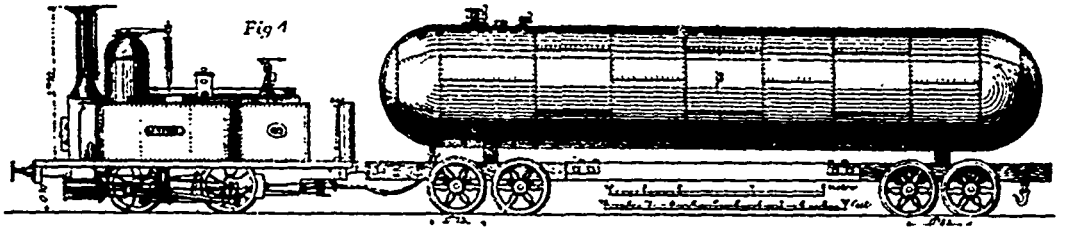
Quite recently a party of civil engineers proceeded to this spot, and were engaged for four or five days in taking most elaborate measurements of the structure, as well as making astronomical calculations. The result of their exhaustive survey have been very striking, astonishing, it is said, none more than the *savants* themselves, and leave not the least doubt about the solar references of the structure; and, further, that it was undoubtedly erected as a temple of the sun.—*The Builder*.

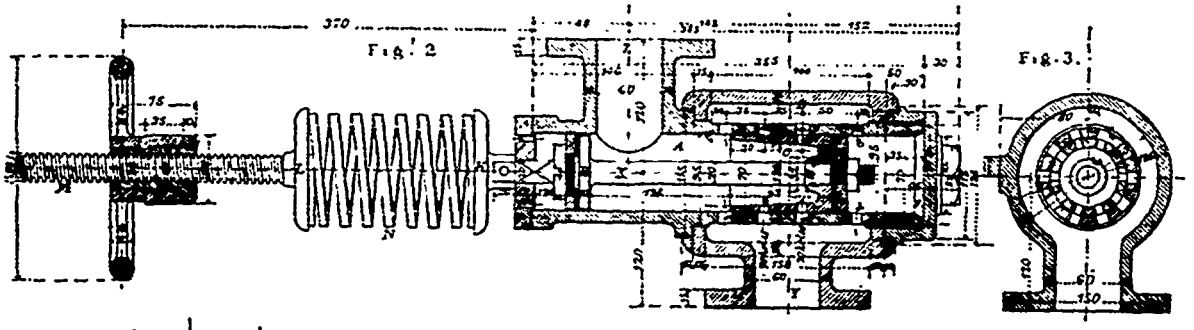
COMPRESSED AIR LOCOMOTIVE AT THE ST. GOTHARD TUNNEL.

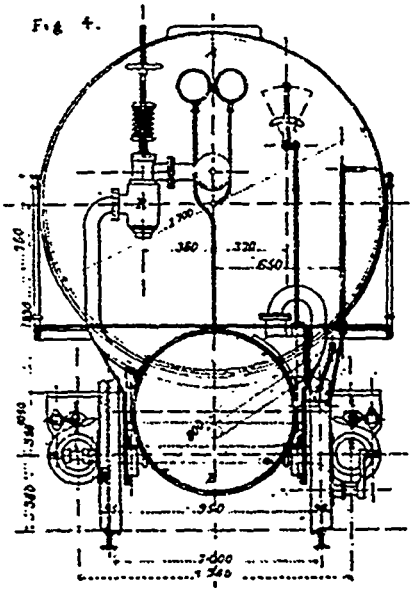


SECTIONS OF COMPRESSED AIR LOCOMOTIVE AT THE ST. GOTHARD TUNNEL.









TRACING-PAPER THAT MAY BE WASHED.

A GERMAN invention, and which may be useful to draftsmen and others, has for its object the rendering more or less transparent of paper used for writing or drawing either with ink, pencil, or crayon, and also to give the paper such a surface that such writing or drawing may be completely removed by washing without in any way injuring the paper. The object of making the paper translucent is, that when used in schools, the scholars can trace the copy, and thus become proficient in the formation of letters and outlines without the instruction usually necessary; and it may also be used in any place where tracings may be required, as, by laying the paper over the object to be copied, it can be plainly seen. Writing-paper is employed by preference, its preparation consisting in first saturating it with benzine, and then immediately coating the paper with a suitable rapidly-drying varnish before the benzine can evaporate. The application of varnish is by preference made by plunging the paper in a bath of it, but it may be applied with either a brush or a sponge. The varnish is prepared of the following ingredients: Boiled bleached linseed-oil, 20 pounds; lead-shavings, 1 pound; oxide of zinc, 5 pounds; Venetian turpentine, half a pound; mix and boil eight hours. After cooling, strain, and add white gum copal, 5 pounds, and gum, sandarac, half a pound. Thus prepared, the paper will be found to possess all the requisites for use as stated above.

MEMORY.

The following articles taken from the *English Mechanic and World of Science*, contain such excellent advice with regard to rules for cultivating memory, and instructions to a mechanic suffering from an overworked brain, that we feel much pleasure in giving them a place in our columns, feeling certain that they will be acceptable and productive of good results to many of our readers.

A friend of mine having acquired an enviably retentive memory for mathematics and other studies through receiving tuition from Mr Wm Stokes, professor of mnemonics (of the Polytechnic Institution), I interrogated him as to the course of instruction by which a species of *backbone* is so furnished to the mental power as to enable them to retain and elaborate the suggestive leading ideas in a lecture, speech, or other composition. Premising that, through its aid persons have, *viva voce*, reported lectures with extraordinary accuracy, also that mnemonics is one of those few arts which it is almost impossible to learn from books and without personal instruction, my friend informed me that the means of effecting and working the requisite association of brain impressions are briefly these A series of easy tables or mnemonical "keys" is given to the student to thoroughly master, and his mind is gradually accustomed to develop a succession of kindred impressions or psychical tableaux therefrom, such tables consisting of a universal key of logic, arranged for debating and composition; keys for statistics, chronology, and history; for mathematics; for the various branches of natural philosophy; for metaphysics; for anatomy and medicine; for jurisprudence, for music, the drama, &c. He is then set to compose or learn a theme in any given branch of knowledge, *e. g.*, a short discourse upon the geological formations; surface or vegetable soil, alluvium, diluvium, pliocene, miocene, &c.; representations of these formations with their characteristics are pictured upon his brain by a remarkably uncomplicated method, and in the required order, in such a manner that he can vividly reproduce them by applying his perfectly-learnt and familiar geological key; each division of the subject being firmly linked with (so to speak) a vertebrate idea consisting of a single word. The actual committal to memory is performed by a simple plan known as "mental reviewing." The brain process which ensues may be illustrated by a telegraph instrument. As the electric current, traversing the wire, communicates to the reading operator an alphabetical character by each depression of the needle, which characters the operator's eye collects into words, so the electricity of thought, grasping and communicating the key-words or vertebrate impressions, forms them into pictorial groups of ideas; moreover, the intellect acquires the habit of instantaneously forming and adapting the vertebrate impressions to the subject in hand. This of course, is, necessarily, all very vague, and we now come to the pith of the matter the contents of the inventor's MS.; as to which I hear you ask, "On what principle are these magical keys formed, and of what do they actually consist? What is the specific method of developing the faculties; how are the thoughts linked together; and, above all, how can each key-word be recalled at a moment's notice?" I am unable to enlighten you on these all-important points, because the system is of the nature of a patent or copyright. I must, therefore, refer you to the inventor of the system of whom I myself intend to take lessons in artificial memory, as my student friend has lately been outstripping me, and as I am, moreover, assured of this that the fact that Sir Stafford Northcote, M.P., who says, "it is peculiarly adapted for following a line of thought." and other have successfully applied the method to public speaking and debating, and that several Oxford and Cambridge professors bear testimony to its usefulness in training the mind, potently assisting the memory, and aiding those who suffer from excessive brain work, is evidence that there must be substantial benefits derivable from its employment.

MEMORY.

You appear to be overworking those nerves in your brain which your occupation calls into play, and your feeling generally out of sorts is probably consequent upon their distressed condition, just as when the nerves of a tooth are disordered we feel miserable all over. The remedy for your affection is change of occupation, giving outdoor work the preference. The next best thing is to get a reduction of the number of working hours, or pay some one to work part of your duty, or get a holiday. If you cannot do any of these things, and must continue to work as you have done, you must endeavour, in the short period you have after business hours, to improve your general health by abstaining from all active brain work; paying increased attention to diet, exercise, and bathing; obtaining more fresh air; cultivating cheerful society, and getting sound sleep. Complete and special directions with regard to diet, exercise, and bathing cannot be safely given you by any one who has not seen you and is unacquainted with your age, temperament, and general habits. I will give a few instructions which will, I am sure, be beneficial, not only to yourself, but to other readers of the *Mechanic* who are suffering from the evils produced by prolonged sedentary employment. First, with respect to diet: Do not take more than three meals a day, and, of course, never eat more than natural appetite demands Your breakfast, or a part of it, should consist of oatmeal porridge and milk. To cook the oatmeal properly, mix four dessert spoonfuls with two teacupfuls of water and a small teaspoonful of salt. Let it steep all night. In the morning put the mixture in a pan, and stir it at short intervals until it has boiled two or three minutes. Take your dinner at a time when you can enjoy it leisurely. Let it consist of no more than two courses. Vary your dishes frequently, not confining yourself to beef, mutton, and veal, but bringing into requisition rabbits, fish, ham and eggs, toasted cheese, fruit pies (the paste not rich), pancakes, rice, sago, and tapioca puddings, or anything which you know does not disagree with you. After a dinner selected from the above, bread and butter or home-made plain or currant cakes are sufficient at tea time. Many persons employed as you are come home wearied out, but drinking tea seems to infuse new life into the system. If that is your case, you must take special care not to use your renewed energy to apply yourself to brain work, to even prolonged reading of novels, &c. Out-door exercise, cheerful society, and rational amusements are what you need, and what, an hour after the evening meal (even if you feel indisposed for exertion,) you must rouse yourself to obtain. You should not take supper, because you cannot, as a rule, do that and eat a substantial breakfast, and it is important you should have that to give you power for your morning's work. A medical man, in your case, would probably prescribe phosphorous; so do I, but I recommend you to get it from oatmeal, which is rich in it, and far more pleasant than the drug the doctor would offer you. Another practitioner (Mr. Halse, for instance) would advise you to galvanise your nervous system with one of his machines, for which he would charge you about ten guineas. I also tell you to galvanise yourself, but I do not offer you a machine; you have one already, given to you by nature –your own body. Well-considered physical exercise, especially of the upper part of the body, is of the greatest importance to you, and if you go about it properly you will strengthen your nervous system in a far better and more natural way than by the use of magnetic machines or chain-bands. As you will probably have to practise at home, you should purchase two dumb-bells, weighing 2 lbs. each, two others 3lbs. each, and for a guide to their use, and to many other excellent physical exercises, you should obtain the best book I ever saw on rational gymnastic exercise viz, Dr. Lewis's "New Gymnastics for Families and Schools," published by W. Tweedie, Strand, London, and pay particular attention to the remarks which precede "Kloss's Dumb-bell Exercises." With respect to bathing, if you have not a bath in the house you should purchase a hip-bath and a large sponge-bath, a flesh-brush, two of the best Turkish towels, and a large sponge. These will cost a rather large sum, but you must not let expense deter you; you could not possibly invest your money in anything more beneficial to yourself or family. When bathing (which should be two hours after a meal) pour into your hip-bath a pail of warm water. Kneeling in the sponge-bath, wash all over with soap and flesh-brush. Then add cold water by degrees until nearly cold, swilling yourself all over repeatedly, with the aid of the sponge, after each addition of cold water. After bathing is a good time for physical exercise, and whether you have dumb-bells or not you should adopt a variety of free exercises Do it easily, and spread them over half an hour or an hour, pausing a few minutes occasionally to rest or walk about the room. Lift, push, pull, or do anything in imitation of natural work that will bring into play the muscles of your chest, sides, back, and arms, but always leisurely and without violence, remembering that your object should be to work them healthfully, and not strain them. Bathing and exercise in the manner described will improve the appetite, strengthen the voice, and enable you to work with much greater ease and steadiness In your case I recommend this bathing and exercise combined about twice a week about 9 p.m.; on the other evenings out-door exercise, or, when the weather is unfavorable, indoor exercise for an hour. I need hardly say you should not have re-

course to drugs or pills, and do not trouble about the state of your bowels. What I have recommended in the best medicine. On no account resort to stimulants, such as brandy, &c., and avoid tobacco, which, though it may seem to soothe your nerves, will probably like opium ultimately impair them. If what I have recommended does not cure you, it cannot fail to do you good, and will make you as healthy as your constitution and your employment and general surroundings will permit. In conclusion, I advise yourself and all readers of the *Mechanic* who wish to know how to order their lives, so as to preserve health, to purchase Dr. Andrew Comb's invaluable work "The Principles of Physiology applied to the Preservation of Health and to the Improvement of Physical and Mental Education." It is published by Simpkin, Marshall, and Co., London, and the price (cheap edition) is about 3s. 6d. Any one who makes himself thoroughly acquainted with and acts upon the information it contains, will seldom need to apply for medical advice to the *Mechanic* or elsewhere.

At a recent meeting of the French Academy P. Secchi presented another of his reports of observations of the solar protuberances and sunspots, the period of observation being from 23rd April to 25th June, 1875. He records the extent of *surface* of the spots (according to a method described), instead of the number as formerly. He finds, *inter alia*, that the daily number of protuberance and the surface of the spots have gone on steadily decreasing, that the large eruptions ceased when the large spots disappeared, that the maxima of protuberances at the poles had disappeared, as also the faculæ which had collected round the poles forming coronas, and that lofty protuberances were becoming very rare. It appears, then, that we are now near the minimum, and that an increase may be expected shortly; and P. Secchi invites astronomers to carefully note the phases of this increase.

Light Sovereigns.—The Bank of England clip every light sovereign that comes into the Bank. The weighing of every sovereign is accomplished quickly; they weigh 3,000 in an hour with one machine. Mr. Palmer, the Deputy-Governor, informed the House of Commons Select Committee of last session on banks of issue that last year the Bank of England weighed coin to the amount of £23,105,000, and rejected £840,000, or about 3·6 per cent., as being light gold. For this last amount the Bank paid the value, making a deduction for the deficiency of weight, which is generally about 3d. or 4d. per light sovereign. It was stated to the committee that boxes of correctly-weighed gold, sent by the Bank of England to Scotland, frequently came back without having been opened, and Mr. Palmer stated that there is then some reduction for light weight. He explained this by adding that the mere shaking of the sovereigns on the journey will make a slight difference. There is a point at which every sovereign becomes light, and many sovereigns turn that on the journey. Mr. Hodgson, M. P., a Bank director, stated that in a box of 5,000 sovereigns the number which would be found to have turned the point would generally be about eight if they have not been disturbed; and he added, "You are aware that the sovereign which is in your pocket at 8 o'clock in the morning is not the same sovereign at 12 o'clock at night." After this rather alarming announcement it is satisfactory to find Mr. Hodgson stating also that the charge for light weight on the eight deficient sovereigns would be about 2d. per coin, making only 16d. on the box of £5,000; so that, says he, "it really amounts to nothing."

Strength of Wood.—In a recent volume of the annals of the Forest Academy at Mariabrun, near Vienna, Professor W. F. Exner gives a novel and highly intructive analysis of the elasticity and strength of wood, its resistance to splitting, and the theory of the use of the wedge, the axe, &c. The importance of these matters he shows to be very great, because great industries depends upon the facility with which the wood can be split, and upon the applicability of certain kinds of wood. Having deduced a few simple formulæ to express the strength of woods and the power of the wedge, he developes a formula for the force with which an axe is handled, and shows what curve should be given to the [illegible] or cheek of the axe, in order to secure, under certain conditions, the least waste of power. By means of the formulæ he is able to demonstrate that the splitting efficiencies of the axes made in America, Prague, and Vienna, are to each other as 4·9, and 13·3 respectively; and applying his formulæ to the elaborate experiments of Nordlingen, he is able to deduce the absolute ease with which various woods can be split. It will thus be seen that the American axe possesses nearly three times the efficiency of the Vienna axe.

Running Off and On the Line.—As a train from Derby to Leeds on the 30th September was running at a speed of about 58 miles an hour between Rawmarsh and Kilnhurst, the tire of the wheel of a composite carriage, the fifth from the engine, flew off the wheel, and the trailing wheels left the rails. After the carriage had been thus dragged for 448 yards, it remounted the rails and ran along them for 28 yards. It then left them again for 280 yards, at the end of which distance it reached the crossings at the south end of the Kilnhurst station platform, where it righted itself. Two carriages then left the rails for a short distance, and returned to them at the crossings of the up-line sidings. The carriage with the fractured tire then again left the rails, and ran 400 yards further, partly in the 6ft. space, when the train was brought to a stand. None of the couplings were broken. The carriages all maintained their upright position, and the two carriages which left the rails were only slightly damaged. Five passengers have up to the present time complained of injury; but there are no deaths.

Colours for Mechanical Drawing. What colour should be used to represent stone on drawings? So far as I have seen architects and builders mostly use are Prussian blue, but this is objectionable as it is the colour almost universally adopted for representing wrought iron. Some few use indigo for stone, but this is very similar to Prussian blue, with the additional objection that it is an "ugly" colour. Smalt and cobalt are occasionally, although very seldom, used. Engineers generally represent soft stone by indigo. The objection to raw sienna and sepia is that in light tints such as are used for elevations on "finished" drawings, there is not sufficient distinction between these and the colour used for elevation of brickwork (yellow stocks, or malms), viz., Roman ochre. I append a list of the colours I consider best qualified (from natural fitness or custom) to represent the various materials, and shall be glad to see the subject discussed in the columns of the *English Mechanic*, and any errors of omission or commission in the following list pointed out:—

Wrought iron	Prussian blue
Cast iron	Payne's grey
Steel	Violet carmine
Copper	Crimson lake with burnt sienna
Yellow Brass	Gamboge
Gun metal	Indian yellow with trace of burnt sienna
Lead	Indigo
Deal and fir	Burnt sienna
Oak	Burnt umber
Yellow brickwork (elevation)	Roman ochre
Ditto (section)	Crimson lake
Red brickwork (elevation)	Venetian red
Ditto (section)	Indian red
Soft stone	Sepia
Granite	Indigo with dots
Mortar an plaster	Neutral tint
Cement and asphalte	Indian ink
Concrete	Payne's red with dots
Water	Prussian blue lines
Leather	Burnt umber
India rubber (red)	Indian red
Ditto (grey)	Neutral tint
Glass	Prussian blue washed
All shading and shadows	Indian ink

The nomenclature of the colours is that adopted by Reeves and Sons.—*English Mechanic.*

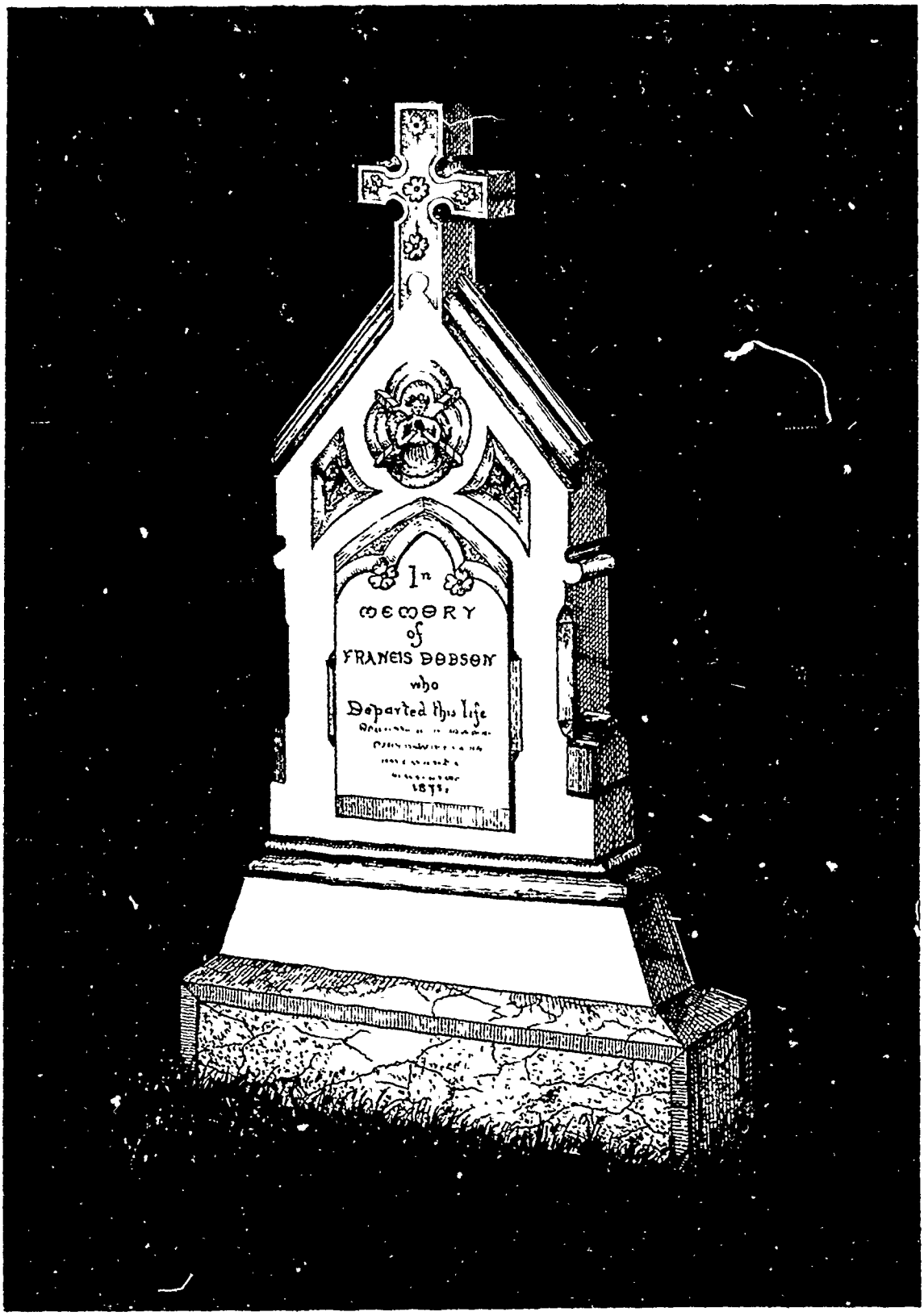
To attach Glass or Metal Letters to Plate Glass.—Copal varnish, 15 parts; drying oil, 5 parts, turpentine, 3 parts; oil of turpentine, 2 parts; liquified glue, 5 parts. Melt in a water bath, and 10 parts of slacked lime.

Bank Note Glue.—Dissolve 1 lb. of fine glue or gelatine in water; evaporate it till most of the water is expelled; add ½ lb. of brown sugar, and pour it into moulds.

Engineers Cement.—Equal parts of red add white lead, with drying oil, spread on tow or canvas. An admirable composition for uniting large stones in cisterns.

Speed of Trains.—The longest distance run by express trains without stopping (according to "Bradshaw,") is from Grantham to York, on the Great Northern line, a distance of 83 miles; and that the trains timed at the highest speed in England are those of the same Company which run from London to Peterborough (77 miles) in an hour and a half, or at the rate of about 51½ miles an hour.

THE MEXICAN RAILWAY; THE INFERNILLO.



DESIGN OF A MONUMENT FROM THE MARBLE WORKS OF W. M. SOMERVILLE, RIDEAU STREET, OTTAWA,

EXHIBITED AT THE LATE PROVINCIAL EXHIBITION, ONTARIO.—1st Prize.

AIDS TO THE ART OF DRAWING.

From Science and Record.

THERE is no accomplishment which is of more genuine advantage than a fair knowledge of drawing. It is, in brief, a universal language which places its possessor in communication with the whole world; and while it is not needful that every man should be capable of producing effects which may be classified as finished works of art, the power of making a neat sketch, correctly proportioned, and also displaying an idea in a graphic manner so as to explain itself at a single glance, is an ability which can not but be of the greatest value in a saving of both money and time.

As the majority of persons, however, are unable to handle the pencil with a sufficient degree of skill to depict their thoughts in a clear and comprehensive manner upon the blank paper, various ingenious mechanical aids have been contrived by means of which the draftsman is enabled to reproduce a correct outline with comparative ease and rapidity. In the accompanying engravings will be found represented a variety of these devices depicted in the simplest and most practical form with ... view of affording the reader a guide for making his own apparatus from the commonest and most readily obtained materials.—See page 372

THE SKETCHING-FRAME.

For those who wish to cultivate the eye, and thus learn to appreciate the difference of distance, without resorting to the more direct tracing of outline necessitated by many of the optical inventions described further on, the arrangement represented in Fig. 1 will be found of much assistance, and particularly in sketching from nature. In this branch of art, the main difficulty lies in seeing too much, and hence, for instance, in an extended prospect, there is a liability to crowd the paper with disproportionate details. Again, the eye naturally seeks for straight lines and boundaries to which to refer, and these absent the mind is obliged to carry imaginary limits, a proceeding of no small difficulty to one not well practiced in so doing. The arrangement in Fig. 1 supplies a simple square frame tightly hinged to the top of the ordinary lap drawing-board, so that it will stand in an upright position. Across this is stretched a number of threads or wires at equal distances apart so as to divide the interior space into small squares. The paper on the board is similarly divided by light pencil lines ruled over its surface. In making the sketch, the artist draws so much of the view as he sees through one of his squares in the frame, into the corresponding ruled square on the paper, and thus having a large number of straight lines to refer to is very readily enabled to locate the details of the picture. It is good practice, after employing the frame thus made for some time, to remove the wires and endeavor to sketch by referring simply to the edges of the former, and by thus progressing, it will be found that before long the apparatus can be entirely dispensed with, the eye becoming sufficiently educated to judge for itself. Of course, the size of the squares ruled upon the paper governs the dimensions of the drawing, and it matters not how small they be made so long as they correspond in number and relative position with those formed by the wires.

COPYING, ENLARGING, OR REDUCING BY SQUARES.

This reduction of squares suggests a convenient mode of reducing or enlarging drawings already completed which is represented in Figs. 2 and 3. Supposing Fig 2. to be the original from which a smaller duplicate is to be made, a number of pencil-lines are lightly ruled over its surface at right angles, and the squares thus formed are for convenience numbered as represented. Then on the blank paper for the copy a similar number of squares are ruled in precisely the same manner, and correspondingly numbered. It is then very easy to fill in each square of the copy exactly so much of the drawing as is seen in the like square of the original. Thus in our figures, the eye in Fig 2 is in square 2-7, and in Fig. 3, it will be noticed that, though smaller, it occupies precisely the same place.

THE TRANSPARENT TRACING-TABLE.

In copying fine pencil drawings, it would hardly do to rule other pencil-lines over their surface, as the application of bread or rubber to remove the same would destroy the original. In such case, a neat arrangement tracing-table, as shown in Fig. 4, might be used. This consists of a square bottomed box, the tops of the sides of which are inclined like those of a writing-desk, abuts against a window. The shade of the latter is drawn down to meet the upper part of the device, so that the light enters through the back of the latter, and the interior being lined with white paper, is reflected up through the inclined glass top. The original drawing might be secured above this glass, and a sheet of tissue-paper, ruled off in squares, placed above it. Being brilliantly illuminated from below, the drawing would readily show through, and thus might be copied square by square, as above described. As represented in our engraving, however, the table is being used for direct tracing. Drawings on even thick antiquarian paper may be attached to the glass, and another sheet of the same material placed above, when still sufficient light will be transmitted to enable the lines underneath to be clearly seen and readily traced upon the upper sheet. The idea is precisely the same as is ordinarily carried out in holding a drawing and blank paper up against a window-pane, and tracing the outlines of one upon the surface of the other.

THE REFLECTING DRAWING-BOARD.

The mention of window-glass recalls another use of that valuable commodity for artistic purposes which of late has become quite popular, judging from the multiplicity of copies of the apparatus represented in Fig. 5, for sale in almost every stationer's store. The device will bring Pepper's ghosts to mind, as these supernatural individuals are produced by an arrangement made on precisely the same principle. It is nothing more than a flat board provided with two uprights, both of which with the board are suitably grooved to hold a pane of glass in a perpendicular position. The drawing to be copied is secured to the board on the left of the glass and the blank paper on the right. The artist now stands as represented in our illustration—that is, so as to look down upon the surface of the glass at a very oblique angle. The original drawing is reflected from the polished surface of the pane to his eye, and at the same time he sees the white paper through the transparent glass, so that the lines of the model appear transferred, but reversed of course, upon the paper. These need only be followed with the pencil, and the outline is made. The apparatus is not of great use where reliable work is required, and indeed seems to us little more than a means of amusement. There are two reflections of the original thrown upon the eye, due to the rays striking both surfaces of the glass at unequal angles, which tend to confuse and render the outline indistinct. Again, unless the original be brilliantly illuminated, the shadow is so faint that the black lines of the pencil appear to blot out the finer details of the lighter portions. The glass must be besides accurately perpendicular, as otherwise a very distorted image is produced, and also be entirely free from defects due to imperfect annealing. The best kind to use, we think, is thin French plate, polished as highly as possible.

THE CAMERA LUCIDA.

Probably the most really reliable optical device is the *camera lucida*, represented in figs. 6 and 7, a simple arrangement extensively used by professional artists for saving time in sketching accurate outlines, of either the same dimensions as those of the originals, or enlarged or reduced. The principle of its construction will be readily understood from the small sketch marked 2 in fig. 6. The glass is simply a four-sided prism, having one right angle, one of 135°, and two of 67½. When disposed as represented, the rays from the object pass into it without any appreciable refraction, and are totally reflected from the lower inclined side, emerging near the summit in a direction almost perpendicular to the top face, so that the eye sees on the paper placed beneath an image of the object. If this image be traced by the pencil, a very correct outline, not reversed, is obtained. The use of this device requires some practice, as there is a difficulty in seeing both the image and the point of the pencil, for the latter really falls further from the eye than the position of the latter. This may be corrected by placing between the eye and the prism a lens which gives the rays from the pencil and those from the object the same divergence. It is, however, necessary to place the eye very near the edge of the prism, so that the aperture of the pupil is divided into two parts, one of which sees the image and the other the pencil. As will readily be understood, the nearer the object is brought to the prism the larger is its image, and the further away it is removed, the smaller the same, so that reduction or enlargement is thus easily made.

Fig. 6 shows the mode of placing the eye, and also the disposition of the apparatus, the construction of which will be understood from the larger view, Fig. 7. This last mentioned drawing has been made directly from the instrument constantly used by Mr. H. E. Mead, special artist of the SCIENTIFIC AMERICAN, and to that gentleman we are indebted for an explanation of an ingenious manner of constructing a device as represented from wood and other simple materials. The prism can be obtained at a small cost from any optician, and the rest of the apparatus any one can

cut out of black-walnut with a knife, and perhaps a gimlet or two. The thumbscrews used are of brass, of the kind employed for shutter-fastenings, and can be procured of any hardware dealer for a few cents each. B, in Fig 7, is the prism and A is a section of one of the joints, showing how the apparatus may be easily adjusted A movable rod secured by a thumbscrew regulates the height of the prism, and the simple clamp shown secures it to the edge of the table. The entire arrangement thus constructed, we are informed, costs, exclusive of the prism a little over one dollar.

MECHANICAL DRAWING.

We continue our examples in mechanical drawing and hope all young mechanics will thoroughly practise the examples until they can make them with neatness and correctness.

THE INTERNATIONAL EXHIBITION OF 1876.

THE ART GALLERY.

This will form a striking feature at the Exhibition to be held at Philadelphia next year. To this building the greatest importance will be attached, as it will be retained, after the remainder of the Exhibition has disappeared, as a monument of the Centennial Celebration. The Art Gallery or Memorial Hall is located to the north of the main Exhibition building on a terrace raised 6 ft. above the general level of the plateau, which itself is 116 ft. above the level of the Sekuylkill river. The building, which is being built of granite, is 365 ft. long, 210 ft. wide, and 59 ft. high, not including the dome, which forms a prominent feature in the design. On page 380 we publish a ground plan of the structure, which, besides explaining its general arrangement, conveys a clear idea of the elaborate floor ornamentation adopted. From this plan it will be seen it possesses three leading features: a main entrance on the south side, consisting of three large archways of equal width, a square pavilion at each corner, and on the south side an arcade on each side of the portal connecting it with the pavilion on the south face On the north side of the building there is also an entrance—of a less elaborate character, however—and the arcades on each side are replaced by a series of arched windows, while between the pavilions is a balcony 275 ft. long, and 45 ft. wide, at a height of 40 ft. above the ground, and commanding a view of the whole of the park grounds. On the east and west side are galleries 98 ft. long, 48 ft. high, and 35 ft. wide, while the centre and side halls together will make a magnificent gallery. The total wall space available in this building will be 71,990 square feet, while the floor space in the spacious vestibule, the centre, and the pavilions will be 16,877 square ft.

THE MEXICAN RAILWAY.

We illustrate this week on page 368 this wild section of the line, which will convey a further idea of the nature of the country through which the railway runs. It was on this section that the value of the Fairlie engines was most strikingly proved, and it was with them that the traffic during construction was carried on upon a temporary line with sharper curves and steeper inclines than those even of the finished work. It is needless to add that Mr. W. W. Evans' much-boasted American engines were entirely unequal to such work.

The ironwork for the piers and superstructure was manufactured by the Cramlin Iron Works Company, who also supplied most of the iron works used on the railway. The rails are carried by traverse sleepers attached to the upper member of the girder, to which they are secured by hook-headed bolts.

The viaduct consist of nine spans of 51 feet each, is on a curve of 350 feet radius, and on a gradient of 1 in 25. Here, as on all the other heavy inclines on the road, steel rails are laid, and guard rails are introduced upon all the curved bridges and viaducts

SOFT SOLDERING SHEET-IRON.—Would any reader practically acquainted give me the required information? It is possible to soft solder ordinary sheet-iron without first scraping the scale off, as to do that would be almost an endless operation in my case? Is there not a simpler method, an acid, or solution, that I might lay on like any ordinary soldering solution, that would have the desired effect? If so, kindly say what, and the proportions for making same?

LECTURES TO LITTLE FOLK.

"Philosophy in sport can be made Science in earnest."

We shall illustrate in the present subject a simple toy which will afford much amusement to the younger branches of a family. This toy is termed the Therma trope, a name compounded from two Greek words which signify a *wonder-turner*, or a toy which performs wonders by turning round (see illustration on page 381.) This philosophical toy is founded upon the well known optical principle, that an impression made on the retina of the eye lasts for a short interval after the object which produced it has been withdrawn. During the rapid whirling of the card the figures on each of its sides are presented with such quick transition, that they both appear at the same instant, and thus occasion a very striking and magical effect. On each of the cards a device is introduced, with an appropriate motto or epigram: the point of which is answered, or explained, by the change which the figure assumes during the rapid whirling of the card.

If you look at the illustration you perceive that it represents a pasteboard circle, on one side of which is figured a rat, and on the other a cage; two strings are to be fastened to the axis of the card by which the card can be made to revolve by taking a string between a finger and thumb in each hand, and slackening, and tightening the strings quickly it will, when set in motion, revolve rapidly round, and thus the rat, which is on one side of the card, will appear when the card is revolving, to be in the cage.

By this curious device a great variety of amusing figures may be made by any member of a family having a taste for drawing.

An improvement on the Thermatrope is shown in figure 1, it consists in inserting in one, or if a still greater change be desired, in both sides of the card two strings, as seen in fig 2, viz.: A D and A E, which united at A form a common string for twirling the card. The cord A D is elastic, while the string A E is incapable of being stretched. If therefore while the card is in the act of spinning, the cord A D be pulled with an increased force, it will take the position D C, while the inelastic string A E will at the same time, assume that of E C; the consequence of which will be, that instead of the card spinning on the axis in the direction A B, it will now spin on that which is in the direction C B, and we shall accordingly see the images on the opposite sides of the card in different positions with respect to each other; at one moment the bottle will be seen in the hand of the drinker as represented in fig. 2, in the next at his mouth, as shown in fig. 3, thus by alternately tightening and relaxing the string, the figure will be seen in the very act of raising and lowering the bottle.

The following are a few figures that can be drawn which will illustrate the device and cause much amusement. Paddy from Cork with his coat buttoned behind. The man must be drawn with a short jacket on one side, and a pair of long skirts on the other, in such a position that when the cord revolves the skirts will appear at the waist in front.—A card with a jockey on one side and a horse on the other. Upon spinning this figure round it will present the combined figure, upon tightening the string as before described, the axis will be changed, and the rider will be instantly canted over the head of his charger, after which by pulling the string with different degrees of force he will be made to stand

AIDS IN THE ART OF DRAWING.

AIDS TO DRAWING.—FIG. 1.—THE SKETCHING-FRAME.

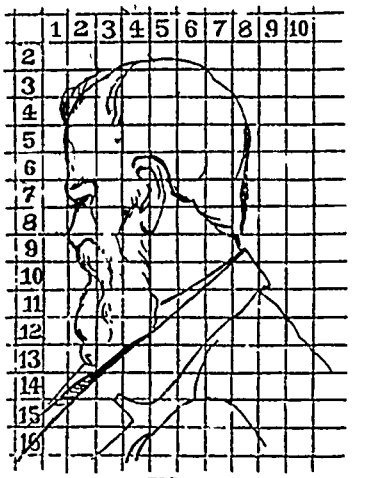


FIG. 2.

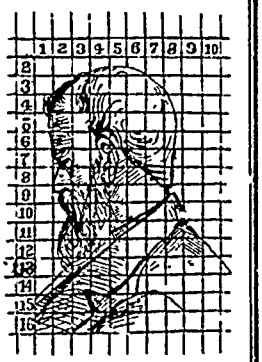
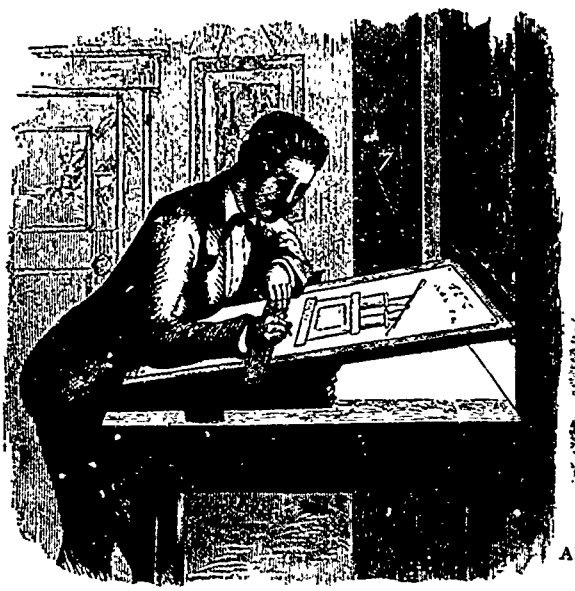


FIG. 3.

AIDS TO DRAWING.—REDUCING BY SQUARES.



AIDS TO DRAWING.—FIG. 4.—THE TRANSPARENT TRACING-TABLE.

AIDS TO DRAWING.—FIG. 5.—THE REFLECTING DRAWING-BOARD.

AIDS TO DRAWING.—FIG. 6.—THE CAMERA LUCIDA.

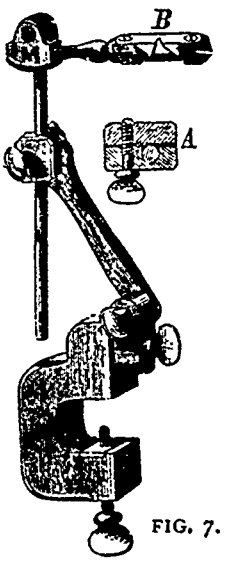
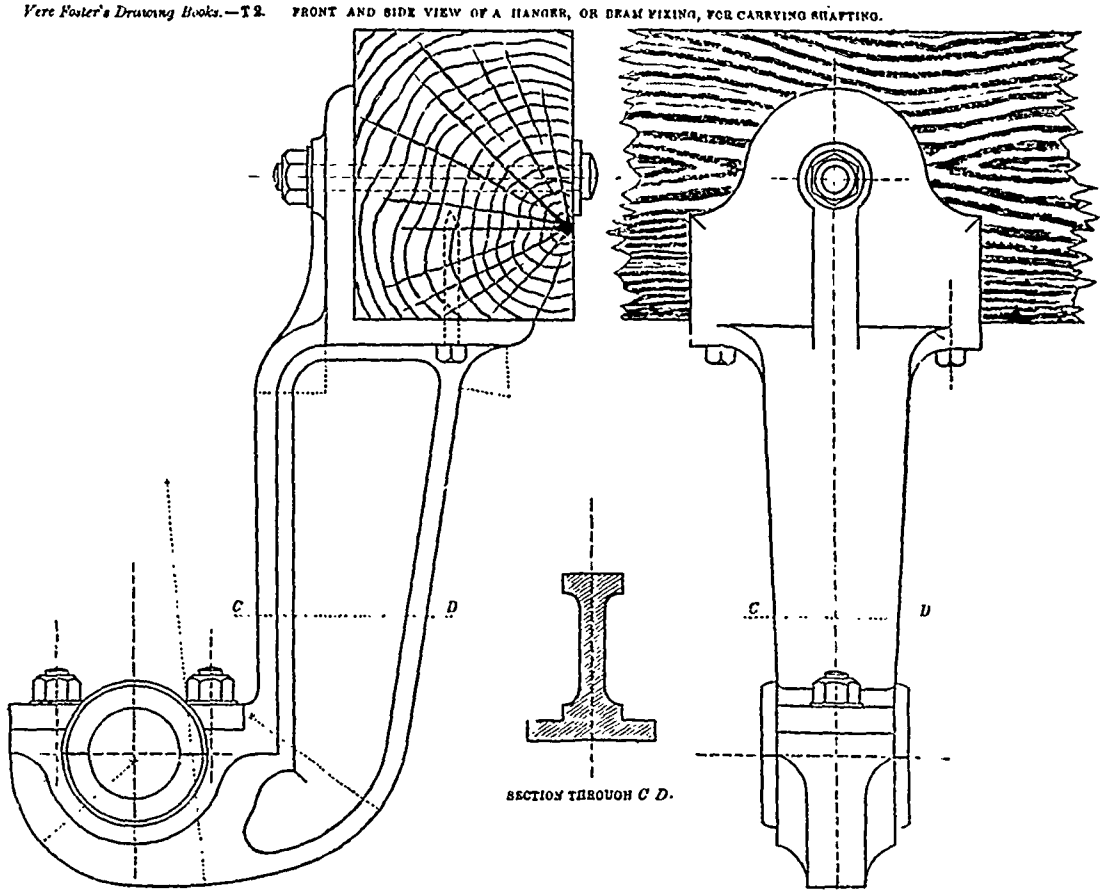


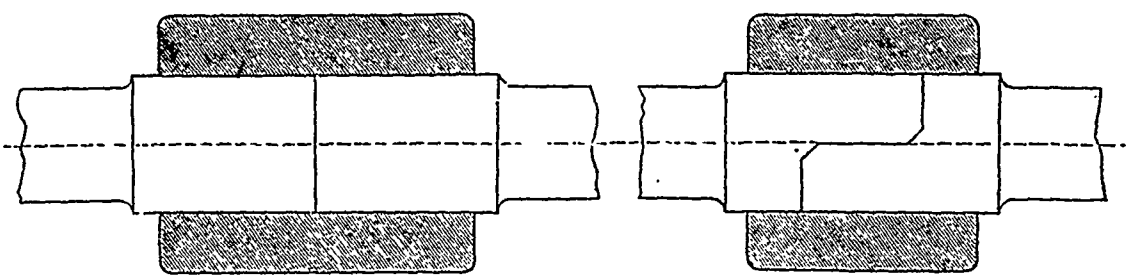
FIG. 7.

MECHANICAL DRAWING.

Vere Foster's Drawing Books.—T 2. FRONT AND SIDE VIEW OF A HANGER, OR BEAM FIXING, FOR CARRYING SHAFTING.

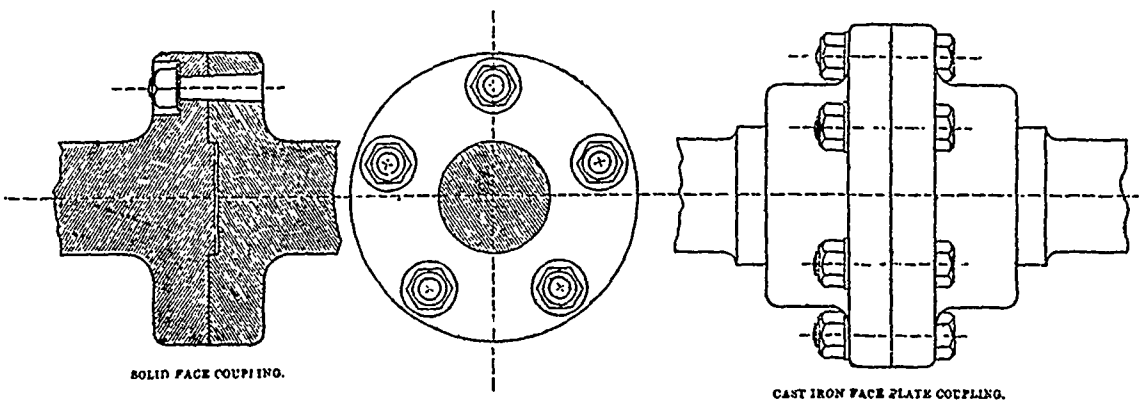


SECTION THROUGH *C D*.



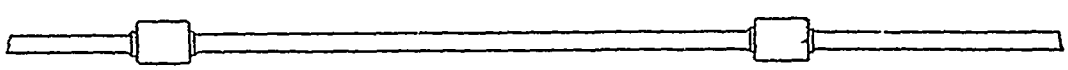
COMMON BOX COUPLING

HALF-LAP COUPLING.



SOLID FACE COUPLING.

CAST IRON FACE PLATE COUPLING.



in the saddle and exhibit a number of different movement.

The figure of an Indian juggler can be represented as throwing two balls, by the same principles he can be made to throw several balls, and by altering and tightening the strings, the balls will be seen in motion.

Another figure we have seen was a pulpit placed on the banks of a pond, the card was made to spin, when a tailor was seen haranguing from the former and a goose, at the same instant, fluttering over the water.

The action of the Thermatrope is therefore upon this optical principle, that the impression made on the retina by the image, which is delineated on one side of the card, is not erased before that which is painted on the opposite side is represented to the eye; and the consequence is that you see both sides at once.

A NEW RHINOPLASTIC OPERATION.

The extraordinary successes which modern surgery achieves were never, I think, better exemplified than in the following rhinoplastic operation, described by Dr. Jas. Hardie in a paper read before the British Medical Association at Edinburgh. The case was that of a young and healthy girl, aged 16, who had lost her nose in early life, and I need not dwell on the serious nature of such a loss to one who probably had to earn her livehood. The nasal bones were entirely destroyed, so that the problem which presented itself was, how to provide a substitute for the nasal bones and cartillages, so as to give the required prominence. This is, perhaps, the most serious difficulty which has to be overcome in rhinoplastic operations. Attempts have been made to meet it by reflecting a piece of the periosteum from the frontal bone; but it is scarcely to be expected that very successful results would follow such a method; and, when the frontal bone has also been involved in disease, it is obviously not to be thought of. After various ideas had presented themselves, and been rejected, the idea of using a portion of one of the patient's fingers was formed. The object to be served being the provision of a support which should have prominence and resistance, and at the same time be capable of assisting in the nutrition of a future covering of skin with which it would be invested, his thoughts were at first directed to the possibility of transplating a toe, as in such respects suitable. At the suggestion, however, of Mr. Peter Totler, a finger seemed much more feasible; and as a portion only would probably be required, this appeared to be a small loss, if a nose could thereby be gained.

Accordingly, an incision was made along the middle of the palmar aspect of the distal phalanx of the left forefinger, with a transverse incision at its base, and reflected two lateral flaps. The margin of the nasal cavity was then denuded, and the skin slightly raised from the bone, so as to allow of its being somewhat everted. In this way, a tolerably broad fresh surface was secured to oppose the flaps from the finger. The parts were then carefully stitched together, the arm being supported by long striped of plaister passed round the neck, over the arm, and under the elbow. A strip of plaister was also passed round the head and over the face; but it was found in a day or two that this was of little service, and it was afterwards discarded.

During the first three days the constrained position caused a certain amount of restlessness, and it was observed that the finger had slightly shifted its position from the perpendicular. After this, however, no further complaint was made, and the parts were left undisturbed for ten days. It was then found that adhesion had taken place on the whole of the left side, but that on the right side there was some discharge under the finger. In the course of another week, when it was considered safe slightly to raise the finger, it appeared that but little union had occurred on the right side, but, as it was hoped that the process of granulation might effect a good deal, the course of matters was not interfered with. It soon appeared that this conjecture proved correct. In time union took place on this side nearly as completely as on the left. Being more anxious, says Dr. Hardie, that the vascular supply between the face and the finger should be complete before I divided the latter, having before me the risk of losing a portion of the patient's finger, without obtaining the end for which the operation was undertaken, I kept the arm bound up to the face for the long period of three months. And it is worthy of remark that, after the first few days, the patient never appeared to suffer from irksomeness of the restraint.

On February 17th, 1875, an elastic ligature was tied round half the circumference of the finger at the middle of the second phalanx. On March 10th the ligature was passed round the other half; and on the 24th the bone was divided with the forceps, thus severing the connection of the distal phalanx with the hand. Both ends of the bone bled, showing a satisfactory vascular supply from the face. This method of gradual separation was adopted as a precautionary measure, in order to assist the newly formed vessels in accommodating themselves to their increased area of supply. The portion of the middle phalanx which remained on either extremity was then dissected out, and the ends covered with the soft parts, the separated phalanx being protected with cotton wool. For some time after the arm was released there was a little stiffness of the elbow-joint, but, in the course of two or three weeks, it had completely passed off. A few days were sufficient to show that vitality was perfect in the whole of the removed phalanx.

On April 9th the alæ were separated from the cheeks and attached to the lower extremity of the transplanted finger. In a fortnight afterwards it was observed that the nail, which hitherto had remained of its original length, had made a considerable amount of new growth, owing to the increased quantity of blood which was now supplied to the matrix, was dissected off, and in the end of the month the aperture, which remained on each side, between the alæ and the original line of union of the phalanx with the margin of the cavity, was closed by sliding a small triangular flap from the cheek over it. The columns was also at the same time attached to the tip of the phalanx.

For some time, the appearance remained remarkably good; but lately the part has receded into the nasal cavity to a considerable extent, so that it by no means fulfils the ornamental purposes it at one time gave promise of, and now it is proposed to cover it with skin, either from the cheek or arm.

This operation has not before been had recourse to, and is consequently interesting from that fact; but it is also interesting in itself, as showing the adaptability of the parts of the human economy, and that notwithstanding their diversified form and character, they are substantially dependent on the cell.

TO STRETCH DRAWING PAPER.

Lay the sheet flat on the board with that side undermost that is to be drawn upon, and with a sharp knife pare the thick edges from the paper: draw a wet sponge freely and rapidly over the upper side, beginning at the centre, damping the entire surface and allow the sheet to rest for a few minutes till all be damped through, and the surface water disappears. Those parts which appear to revive too soon retouch with the wet sponge, the damping should be done as lightly as possible and with little friction; now turn the sheet over and place it exactly in position on the board and lay a straight edge or square on the paper within ¼ of an inch of the edge of the paper and fold back a margin upon it, smear over this margin with melted glue, the paper is then folded back on the board and the superfluous glue pressed out with a paper folder or other smooth article, the same operation being rapidly applied to the other edges the sheet is then left to dry.

STRAIGHTENING A FACTORY CHIMNEY.

The chimney-stack (132 ft. high) of Messrs. Peter Mathews & Son's Chemical Works, Pitchcombe, Stroud, built in 1862 by Mr. Gideon Morris, had gradually fallen on one side until it was 3 ft. 10 in. out of the perpendicular. Mr. H. J. Taylor, of Nailsworth, lately undertook to restore it to its original position, without the use of scaffolding. He was assisted by three workmen. The chimney is octagonal, and the operation of Mr. Taylor consisted in cutting out one course of bricks from five of the sides, and inserting a thinner course, and then letting the chimney fall upon the latter and so pull itself upright. For this purpose he erected a platform about 40 ft. from the base, and with hammers and chisels he and his men cut through the chimney, which at this point was of the thickness of about 2 ft. As the bricks were removed from each side, a thinner course was substituted, and the intervening spaces were filled with iron wedges. This work lasted for about three weeks, and unfortunately the weather was most unfavourable, being frequently very boisterous. However, the chimney stood through it all, and when everything was in readiness for the *coup de grace*, the wedges were withdrawn by Mr. Taylor and his three men, and the lofty stalk was brought within an inch or two of its perpendicular position. This finishing stroke was performed on the evening of the 5th inst.

GOTHIC MARBLE CROSS.

On page 369, we give a sketch of a monumental cross exhibited by Mr W M Somerville, at the late Provincial Exhibition of Ontario at Ottawa, from his Marble and Granite works on Rideau Street, in that City This monument received the *first prize*, and was deservedly worthy of the high commendation passed upon it for its symetrical proportions and superior finish. Mr. Somerville received also *first prize* for the best mantle-piece. All of the articles exhibited by him were highly creditable to his establishment.

BRONZES INCRUSTES.

This is the name given to a new style of bronze or copper work ornamented with gold and silver, and manufactured by Christofle & Co., in Paris. The ornamentation is produced by etching and electro-plating, and consists, according to Dr. Mendinger, in the following operations: After the object, which may be of massive copper or bronze, has received the desired form, the drawings are made with water-colors, the body of which is white lead. If several pieces are to have the same design, it may be printed on as in porcelain and fayence painting. Those portions of the surface not painted are covered with varnish. The article is then placed in dilute nitric acid, whereby the paint is dissolved and the surface of the metal is etched to a certain depth. When the etching is finished, the article is washed with water and immediately placed in a silver or gold bath, and a layer of the precious metal deposited by electricity on the exposed portions. When the latter operation is finished, the varnish is perfectly removed and the whole surface ground or polished, so that the ornamented portion is just even with the remainder of the surface. The contours are quite sharp. The surface is then bronzed, which does not change the color of the gold or silver A specially fine effect is obtained by producing a black bronze or sulphuret of copper on portions of the surface between the silver ornaments. A copper vessel then has three colors—black and white drawings on a red-brown ground of suboxide of copper.

This new process for ornamenting metal has devised at Christofle's works since the Paris Exposition of 1867. Specimens exhibited at Vienna in 1873 show the high degree of perfection to which it has already been brought. Unfortunately these goods are so expensive as to be only accessible to the few, although much cheaper than those in which the engraving is done by hand and the gold and silver inserted by mechanical means. The production of an incrustation requires a high degree of manual skill and patience, but no costly machinery: indeed, every brass foundry contains all the necessary tools for the mechanical operations.—*Lon.*

At the Maritime Exhibition at Paris a new manufacture is exhibited in the shape of Cuir-liege, or leather cork It is prepared by cutting cork into thin sheets, and dressing them on both sides with india-rubber; and the combined fabric is said to possess properties which would scarcely be expected from a knowledge of its component ingredients. For instance, it may be wrung like a cloth, twisted or doubled and beaten with a mallet without exhibiting friability, or, indeed, sustaining damage. It is waterproof, and is exhibited in the form of buckets which have been full of water since the exhibition opened. It is heat-proof, and though light is remarkably strong, a strap 1½ inch wide and about ⅛ inch thick, having sustained a weight of about 500 kilos. for many weeks. Finally, it is said to be cheaper than leather—will make good portmanteaus, seats, belts, knapsacks, &c. Surely it will not be long before it is offered for sale in this country

Elastic Moulds for Electrotyping.—Break glue in small pieces and soak until quite soft, drain off the water, and heat in common glue-pot with treacle (1 of treacle to 4 of glue) till it nearly boils It must be thin enough to flow. Pour it on while hot, and let it have about 14 hours to harden. If model is of plaster it must be thoroughly saturated with oil.

Another good composition is made by soaking glue in water till quite soft, and then mixing treacle with it till it is somewhat thicker than treacle itself. This is poured on the model, and allowed to set, the moisture being squeezed out as often as possible. When sufficient set to allow of its being cut, a slip is made from top to bottom, which it will allow of the model being taken away, and will spring back to its proper shape. As to coating, use best blacklead.

INDIA AND THE PRINCE OF WALES.

So much public attention is at present being directed to the visit of the Prince of Wales to India, that several of the principal Illustrated English Papers have special Supplements containing over 40 pages of illustrations and description printed for the purpose of gratifying the public with information not only of the Prince's actual tour and reception throughout the country, but conveying to them in a general and pleasing way much historical matter connected with the past and giving an excellent sketch of the habits and manners of the Hindoo nation as it at present exists. Our space will not allow of giving any of the interesting details which are particularly well noticed in the *London Illustrated News* and the *Graphic*. We have, however, given an excellent illustration of Her Majesty's steamer *Serapis*, which has been specially fitted up for the Prince and a very perfect miniature map of *India* showing the route laid down for the political tour of his Royal Highness If any particularly attractive occurrence should take place we will not fail to give of it an illustration.

PATENT INTERNAL CLAMP COUPLING.

This excellent Shaft Coupling was exhibited at the late Ont. Prov. Exhibition by W. P. Bartley & Co., Montreal, who is the manufacturer. It is formed from one casting, combining the inner clamps with the outer casing, between which are inserted, lengthwise, fine thread taper screws bearing the whole length. The clamps, being divided across the centre of the coupling, are thus made independent of each other, which enables them to grasp firmly the end of each shaft, whether the latter are of equal or slightly different diameters. This feature is indispensable in a really good coupling, for it is not possible for one having no such provision of the clamping parts to hold firmly the ends of two shafts that vary, however slightly, in diameter; for, without exception in all such cases, the larger shaft will prevent the coupling from clamping the smaller one, and the latter will soon work loose; or, should both shafts be a trifle smaller than the hole through the coupling, they will be held only by two points, and will gradually work loose and give trouble.

We were informed that there are at present several thousands in use, giving the greatest satisfaction in every place.

We may mention also that the same device, as applied to this coupling, has been, and can be used profitably for the hubs of pulleys, gears, &c., for which it is also patented.—*Ed. C. M. Magazine.*

Iron Nuts-Machine, Plow and Carriage Bolts Cant-Hooks, Turn-Buckles, Threshing Machine, Spikes, &c.

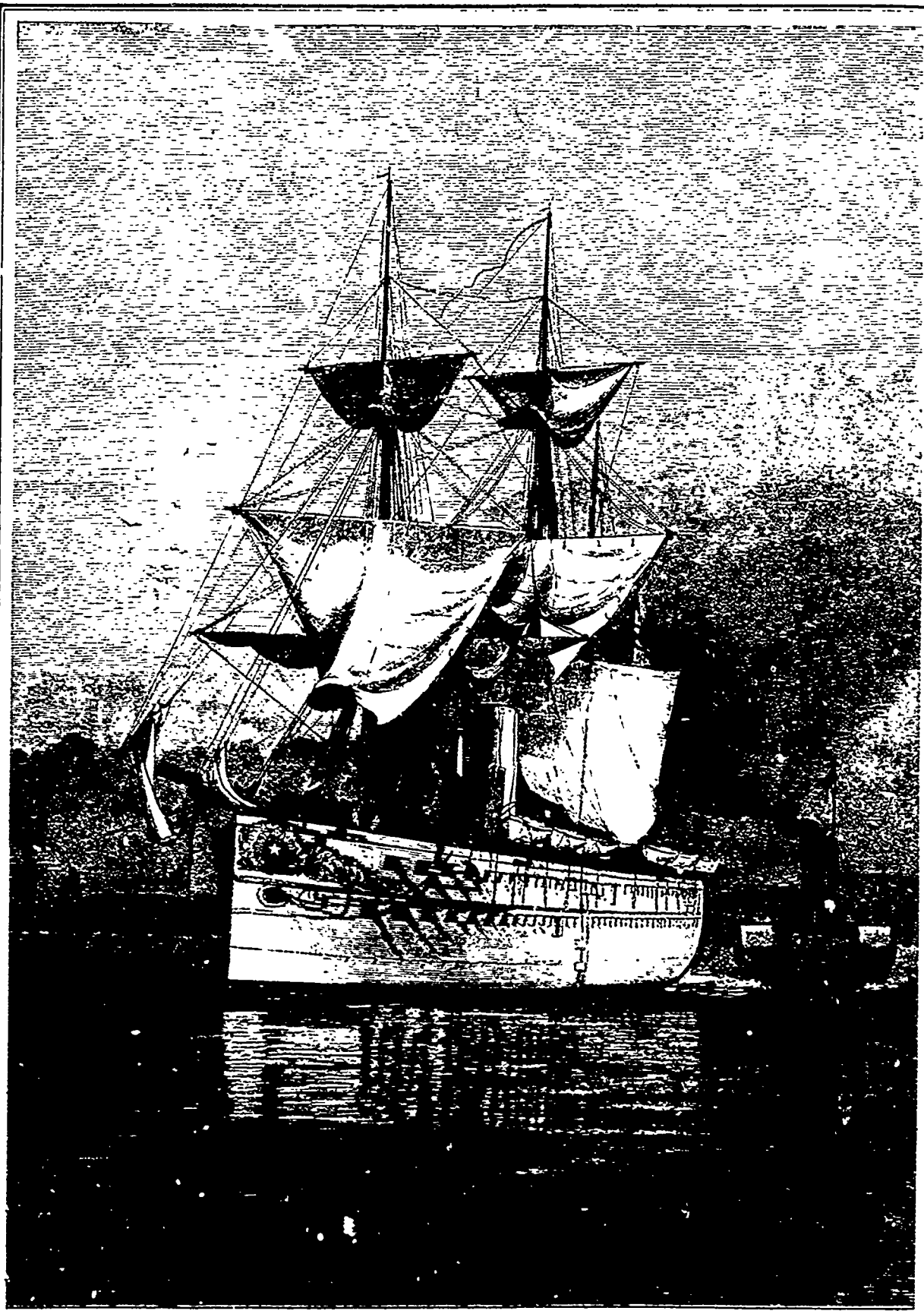
We had not space in our last Number to notice the articles mentioned in the above heading, which were exhibited by Mr. George Gibbs, of Port Hope, the manufacturer, and of which we give illustrations in our advertising columns.

The Hammer made Forged Nuts, *square and hexagon* from ¾ inch to 1½ inch seemed particularly well finished, as well in fact was all his forged work. The *Pinch* or *Crow-Bar* and *Cant-Hook* is a very great labor, saving and convenient tool for every one having to work on heavy logs, and is quickly adjusted to any sized timber; the hook can be detached by simply turning the set screw, and sliding it over the end of the bar.—*See illustration on inside of the back cover.*

IMPROVING SPOILED BUTTER.

An excellent process intended to improve spoiled butter was patented here in 1859, and therefore expires in about a year hence. It is founded on the fact that the butter in barrels spoils first and mostly from the outside, the hoops and staves are therefore removed from the spoiled butter, it is surrounded with a bag, and the whole buried in charcoal contained in a large barrel or any other suitable receptacle. The well-known and wonderful absorbent power of the charcoal for odors removes all strong flavor from the butter, and soon gives it the appearance of a fresh article, saleable in the market at a price far in advance of that which rancid butter brings.—*See page 384.*

Saturn.—What is the smallest telescope that will show the shadow of the ring on the planet? I thought I blimgsed it with 134 on my 2¼ in. aperture. Was I mistaxen? The eye-piece was a single-lens one giving a good light.



H. M. STEAMSHIP *SERAPIS.*


A MAP OF
INDIA
Showing the Route of H.R.H.
THE
PRINCE OF WALES
1875
ARABIAN SEA
BAY OF BENGAL
CEYLON
Colombo
Kandy
Laccadive Islands
Maldive Isl^ds
Hindu Kush Mts
Kashmir & Jamoo
PUNJAB
Lahore
Delhi
Rohilcund
Bikanir
Rajputana
OUDE
Agra
Lucknow
Allahabad
Benares
Behar
Calcutta
Chota Nagpur
Gwalior
Indore
Bhopal
CENTRAL PROV.
BERAR
Hydrabad
Bustar
Karond
Mysore
Cutch
Kattywar
SIND
Hydrabad
Palanpur
Mullah
Himalaya
TIBET
BHOTAN
Tirhoot
Sikkim
Bundelcund
RUSSIAN EMPIRE
INDIAN OCEAN

WHAT TO DO IN CASE OF ACCIDENT.

Accidents more or less serious are occurring so frequently in daily life, particularly among mechanics, that every member of a family should consider it a part of his education to know "*what to do and how to do in case of accident*," as a long interval of time may elapse before medical assistance can be obtained, and even the sufferer may perish from the want of sufficient surgical knowledge on the part of his family how to stop the effusion of blood. We quote a few remarks on this subject from a small manual by Mr. John Phin, editor of the *Technologist*.

"Little danger need be apprehended from ordinary cuts, even of considerable extent, provided no important blood vessel or other organ is injured. In case of a clean cut, the blood should be stanched by bathing with cold water, and all extraneous matter should be removed with a soft, clean sponge. The edges of the wound should then be brought together by strips of sticking-plaster, a space being left between the strips for the escape of any blood or fluid. When a wound is large, and the edges gape, or where there is a piece of skin not quite separated, stitches may be usefully applied together with plasters. They are formed by passing a needle and thread about a quarter of an inch from the edge of the wound, from without inwards on one side, and from within outwards on the opposite one, and then fastening the ends of the thread together with sufficient tightness to prevent the surfaces from separating. One or more stitches should be made, according to the extent of the cut, an inch or more apart from each other, and between these the parts should be supported by strips of adhesive plaster. If the cut be on a limb, a roller or bandage should be gently passed around it. The stitches must not be drawn together with too great force, or they may cut through the parts. They should not remain in too long. They will generally have answered every useful purpose in forty-eight hours; but when they do not cause irritation, they may be left in for three or four days. They may then be removed by cutting the threads and drawing them away by the knot. When stitches are used a bandage is not always necessary. A piece of lint spread thinly with cerate will generally be sufficient.

"A torn or lacerated wound may be caused by a hook or nail, or any blunt instrument. The wound and torn portion must be carefully cleaned with a sponge and water, and laid in the position from which it was torn. The edges must be brought together by stitches and sticking-plaster and the whole covered by a poultice or water-dressing. Where parts are torn, provided a portion remains united, they may be managed in this way with every probability of union taking place. The nose when nearly separated from the face has been united by careful adjustment of the parts.

"Wounds arising from blows or falls require prompt treatment; but generally the immediate danger arises from shock to the system, and until the arrival of the doctor, our efforts should be directed to making the patient as comfortable as possible, lessening the pain and keeping up the vital forces. Warm applications, such as a large bread poultice, or hot fomentations by mean of frequently renewed flannels, should be made to the wounded parts. These soften the skin and relieve the pain. In some cases cold water is most refreshing. In every case of a severe wound of this kind a surgeon should be immediately called, but in cases of slight contusion it is desirable to avoid the disfigurement which results from blows on the countenance. The best example of this form of wound is the ordinary "black eye," which frequently proceeds from other than disreputable causes. The injured part must be kept at rest, and covered with cold, wet cloths; or it may be bathed or kept moist with the following preparation

Tincture of Arnica.	1 ounce.
Muriate of Ammonia.	1 drachm.
Spirits of Wine.	2 ounces.
Water.	3 ounces.

"When applied to wounds on children it should be diluted with one-third to one-half its bulk of water. This solution has an admirable effect in preventing inflammation and excessive discoloration. We may here note that the common specifics for a black eye, such as beefsteak, &c., are very good, but no better than so much cold water.

"Sprains are the result of straining or tearing the ligaments of a joint. They are attended with very severe pain, often causing faintness and vomiting. There is generally considerable swelling. If the injury is at all severe a surgeon should be consulted at once, as it is often difficult to ascertain whether dislocation or fracture has taken place. "It would be better to break a limb than sprain a joint," says Mr. South; "the former in ninety-nine cases out of a hundred being cured in the course of a few weeks, if the skin have not been broken; whilst the effects of the latter may at best remain for weeks or months as weakness or stiffness in the joint." Perfect rest of the injured joint is the only effectual means of cure. Warm, moist flannels should be repeatedly applied to the sprained joint for some hours, and a bread and water poultice on going to bed. These should be continued for a few days. If the pain continues to be severe leeches may be applied. When the tenderness has subsided, a vinegar poultice is a very good application, as it produces a diversion of the low inflammation going on in the ligaments by bringing out a crop of pustules on the skin, at a time when pressure from rubbing with any stimulating liniment cannot be borne. When the pain has entirely ceased, the joint must be very carefully used.

"The best remedy for ivy-poisoning is said to be sweet spirits of nitre. Bathe the parts affected freely with this fluid three or four times during the day, and the next morning scarcely any trace of poison will be found. If the blisters are broken to as to allow the spirits to penetrate the cuticle, a single application will be sufficient.

"The wounds inflicted by bees, wasps, and hornets are exceedingly painful, though not often dangerous. To relieve the pain of such a wound, extract the sting, which is always left behind by bees, and bath the parts with cold water, or apply a good poultice of common clay mud. Liquid ammonia mixed either with the water or the mud will prove of service. All liniments which require rubbing are bad as tending to irritate the part and diffuse the poison. Above all avoid scratching the wound."

As mechanics are very liable to accident, these instructions should be particularly borne in mind. – ED. C. M. M.

THE *Scientific American* thus describes the latest Yankee notion: "Imagine, ye mothers of large families, who ruefully contemplate dilapidated socks by the dozen, after the week's washing, with visions of strained eyes and tired backs floating across your minds: imagine a little apparatus infinitely more simple than the sewing machine, which repairs the hugest darn in much less time than we can describe the operation, and far more neatly than you can do it with all your years of practice. This is what it is. Two small plates, one stationary and the other movable, are placed one above the other. The faces are corrugated, and between them the "holy" portion of the stocking is laid. Twelve long eye pointed needles are arranged side by side in a frame, which last is carried forward so that the needles penetrate opposite edges of the hole, passing in the corrugations between the plates. Hinged just in front of the plate is an upright bar, and on this is a crosspiece carrying twelve knobs. The yarn is secured to an end knob, and then, with a bit of flat wire, pushed through the needle eyes. Then the loop between each needle is caught by the hand and hooked over the opposite knob, so that each needle carries really two threads. Now the needles are carried back to their first position, and, in so doing, draw the threads, which slip off the knobs through the edges of the fabric. A little push forward again brings the sharp rear edges of the needle eye against the threads, cutting all at once. This is repeated until the darn is finished, and beautifully finished it is. The inventor is Mr. O. S. Hosmer of Boston, and we predict for him the blessings of the entire feminine community. The cost of the machine is but ten dollars."

TO CEMENT GLASS ON BRASS. A cement is used by Pusher which is particularly serviceable, says the *Druggist's Circular*, in attaching the brass mountings on glass lamps, as it is unaffected by petroleum and all of the class of burning-fluids. It is prepared by boiling three parts of resin with one part of caustic soda and five parts of water, thus making a kind of soap, which is mixed with one half its weight of plaster of Paris. Zinc-white, white-lead, or precipitated chalk may be used instead of the plaster; but when they are used, the cement will be longer in hardening. It has a great adhesive quality. The possibility of dissolving it to remove the mountings will recommend it to many persons.

SOFTENING AND TOUGHENING WOOD.—G. W. SWAN, of San Francisco, states that if blocks of wood intended to be used for cutting veneers are first boiled or steamed in a solution of ammonia and borax, they will not only become soft and easy to cut, but the veneers formed from them will retain their flexibility for an indefinite length of time.

SHARPENING EDGE TOOLS.

Very few general amateurs have sufficient practice to acquire, or to retain when acquired, the knack of producing perfectly flat facets on their plane-irons, chisels, &c.

By the aid of the following simple contrivance, put together very easily, the end may be attained with despatch and certainty, the shavings leaving the plane with the real professional "whistle."

A simple saddle of wood, with a thumb screw and clamp, or dog, for fixing the tool firmly to the cross bar. The oil-stone is placed between the cheeks and the tool, so adjusted that the saddle bears with its heels or hinder angles, A and B, on the bench, the tool, of course, bearing on the oil-stone. The saddle, and with it of course the tool, is then worked backwards over the stone.– H.B.

A GLUE WHICH RESISTS THE ACTION OF WATER.

Potassium bichromate unites with gum, glycerine, glue, etc., forming, when exposed to light, a substance insoluble in water. By adding a small quantity of a solution of potassium bichromate, which has been prepared in the dark to glue, a compound is obtained possessing the cohesive properties of glue, but totally insoluble both in hot and in cold water.

Sausages containing peas were used in immense quantity by the soldiers in the Franco-German war, but a difficulty was experienced in obtaining gut as an envelope for the sausages; parchment-paper, was accordingly employed. It was found that ordinary gum would not answer the purpose of joining together the seam, as it could not resist the influence of water. The glue, above described, has been employed with advantage by Dr. Julius Strude in Hamburg. Three per cent of bichrome is added to the ordinary glue or gelatine solution. The strips of paper joined by the glue are dried quickly and exposed to light till the glue changes to a brownish color; they are then boiled with water containing 2-3 per cent of alum till all potassium bichromate is extracted, and then washed in cold water and dried.

MATERIAL FOR BUILDING.

A material suitable for blocks and bricks is, according to the invention of Messrs. Smith and Patterson, of Glasgow, made from two mixtures. The first contains coal tar, mixed with small broken stones or shingle, a portion of which should be pulverised or mixed with sand, so that the interstices between the stones of larger size may be properly filled up. The second mixture is composed of clay and pitch; sand or chalk may be substituted for the clay. The first mixture is mixed in a mixing apparatus at a heat which is gradually increased until the product is adhesive to the touch. The second mixture is formed by grinding the power thus obtained, and is added to the first mixture while its particles are adhesive to the touch. The mixture of the two compounds is confined in a close vessel and heated so as to diffuse the vapours uniformly throughout the ingredients. In manufacturing a building block, the material having been tested, is removed while hot to moulds, and pressed and shaped as required.– *The Builder.*

TRACING-PAPER.

A convenient method for rendering ordinary drawing-paper transparent for the purpose of making tracings, and of removing its transparency so as to restore its former appearence when the drawing is completed, has been invented by C. Puscher. It consists in dissolving a given quantity of castor-oil, in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge. The alcohol evaporates in a few minutes, and the tracing-paper is dry and ready for immediate use. The drawing or tracing can be made either with lead-pencil or india-ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet.

MARBLE.

To remove ink stains from white marble, make a paste with a little chloride of lime and water, and rub it into the stains; afterwards sponge with soap and water.

QUERIES.

1001. Priming for Canvas for Oil Painting. Could any of your correspondents give the best method for the above I cannot conveniently obtain the prepared canvasses of the artist and colourmen, and would like to be informed of the best method of preparing it.—Amateur.

1002. Lettering Sheet Brass.– I wish to be informed what is the best way of lettering brass, perhaps some of your correspondents would kindly inform me through your columns.– G.H.M.

1003. There are several kinds of wood fillings in use, but most of them stain light colored wood, which I wish to keep of its original colour, favor me a suitable receipt.

1004. Headache. — I suffer severely from headache which generally last from 24 to 30 hours. As I take plenty of exercise and are of very temperate habits, and of a healthy constitution, I know not whether to attribute it to Neuralgia, or some slight derangement of the stomach. I have generally remarked that it more frequent comes on after taking unusual exercise. Medical men treat as of no consequence, but as it continues me often to bed, while it lasts, I lose many hours work (which to me is money) during a year, some other suffer may be able to prescribe a simple and effectual remedy.—Mechanic.

1005. Aquarium.—Would any reader kindly inform me how I can keep the water of my aquarium from getting green? I have tried shading and reducing the quantity of plants. The aquarium is outside in a southern aspect.

1006. Lacquer.—What is the composition of lacquer for the brass bands for window curtains; and for the dark bronze for a gaselier or in what book can I find the information?.

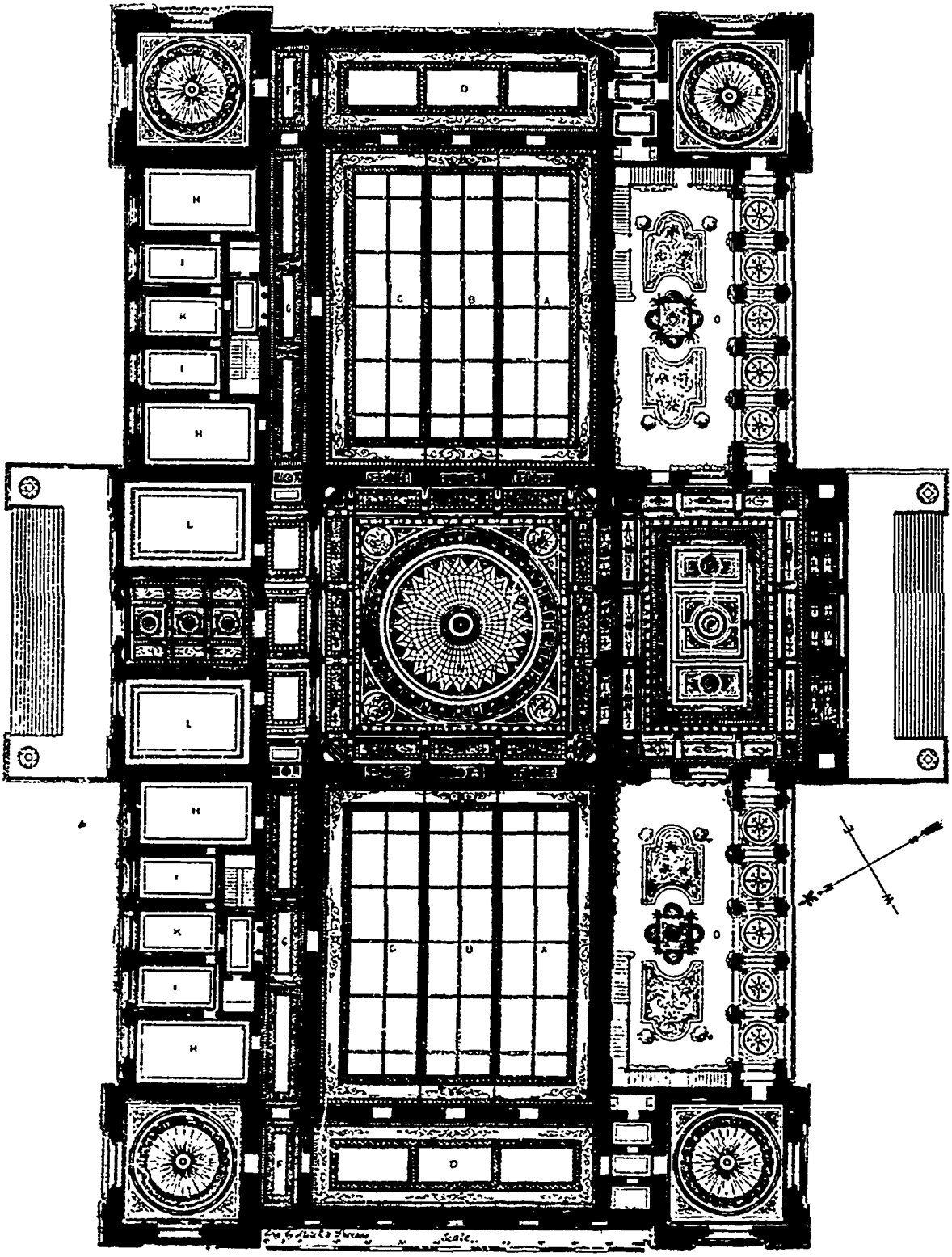
BLACK VARNISH FOR ZINC.

Professor Bottger prepares a black coating for zinc by dissolving 2 parts nitrate of copper and 3 parts crystallized chloride of copper in 64 parts of water, and adding 8 parts of nitric acid of specific gravity. This, however, is quite expensive; and in some places, the copper salts are difficult to obtain. On this account, Puscher prepares black paint or varnish with the following simple ingredients: Equal parts of chlorate of potash and blue vitriol are dissolved in 36 times as much warm water, and the solution left to cool. If the sulphate of copper used contains iron, it is precipitated as a hydrated oxide and can be removed by decantation or filtration. The zinc castings are then immersed for a few seconds in the solution until quite black, rinsed off with water, and dried. Even before it is dry, the black coating adheres to the object so that it may be wiped dry with a cloth. A more economical method, since a much smaller quantity of the salt solution is required, is to apply it repeatedly with a sponge. If copper-colored spots appear during the operation, the solution is applied to them a second time, and after a while they turn black As soon as the object becomes equally black all over, it is washed with water and dried. On rubbing, the coating acquires a glittering appearance like indigo, which disappears on applying a few drops of linseed-oil varnish or "wax milk," and the zinc then has a deep black color and gloss. The wax milk just mentioned is prepared by boiling 1 part of yellow soap and 2 parts Japanese wax in 21 parts of water, until the soap dissolves. When cold, it has the consistency of salve, and will keep in closed vessels as long as desired. It can be used for polishing carved wood-work and for waxing ballroom floors, as it is cheaper than the solution of wax in turpentine, and does not stick or smell so disagreable as the latter. A permanent black ink for zinc labels is prepared by dissolving equal parts of chlorate of potash and sulphate of copper in 18 parts of water, and adding some gum-arabic solution. The black polish above described is recommended as permanent and capable of resisting quite a high temperature.

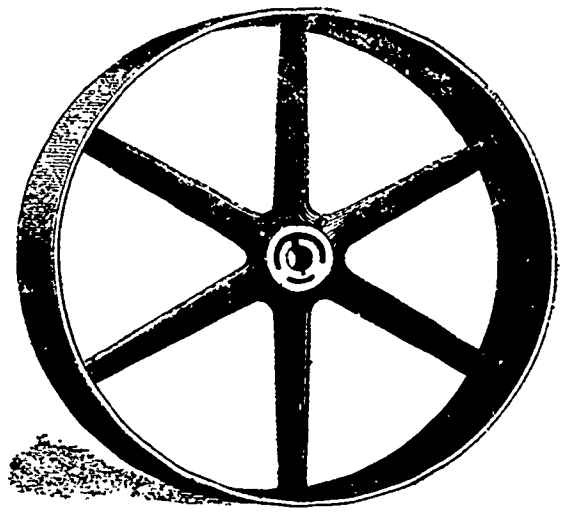
Paint for Lettering Blinds (Calico or Canvas.) Will any kind reader please say what the paint for the above is composed of—how it is made so as not to grease, stain, or run?

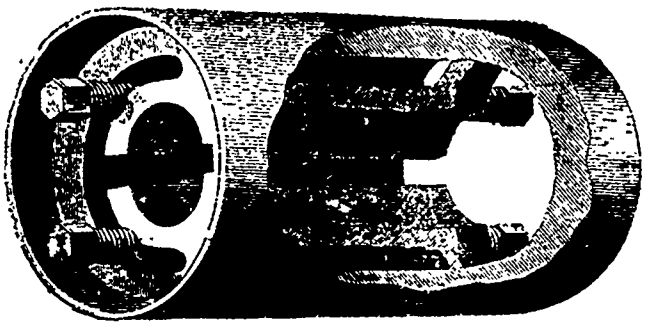
Silicate Making.—I am very much interested in the article on silicate wall colouring, and shall be glad to know if I can manufacture the silicate; can I fuse the sand and soda in an ordinary crucible? or what apparatus shall I require, and what is quartzose sand? I suppose it is quartzose rock ground to powder. Can it be obtained in Canada and where? I do not wish to attempt to manufacture for sale, but for use.

THE CENTENNIAL INTERNATIONIAL EXHIBITION OF 1876.—PLAN OF THE ART GALLERY.



PATENT INTERNAL CLAMP-COUPLING, Exhibited by W. R. Bartley & Co., Manufacturer, Montreal.

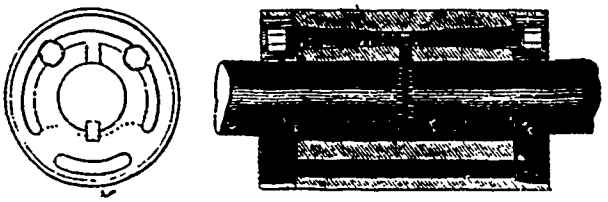




PATENT INTERNAL CLAMP COUPLING
FOR SHAFTING.

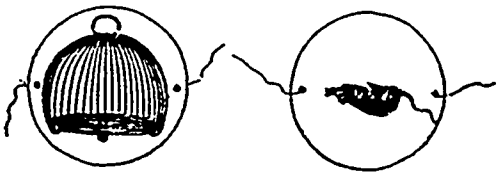
PULLEY WITH PATENT INTERNAL CLAMP HUB.

SECTION.



THE THERMATROPE, a Philosophical Toy.

Fig. 1.



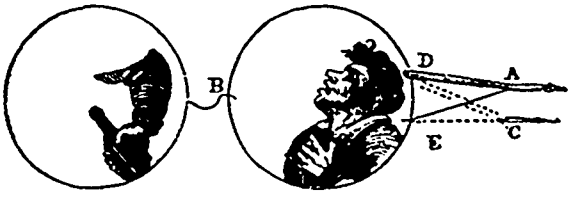
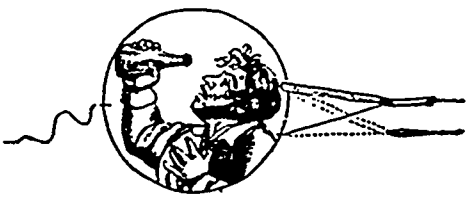
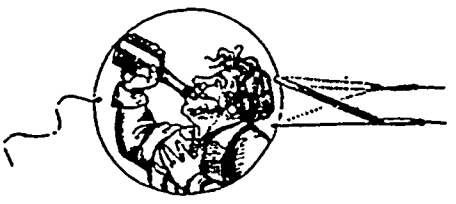


Fig. 2.





DOMESTIC.

THE ART OF FRYING FISH.

Several kinds of fish are fried when small: such as small trouts or troutlets, carps, tench, sun-fish, pike, pickerel, flounders, white-fish, black and blue fish, perch, porgy, mullet, weak-fish, herring, bass, and the like, and smelts, which never grow above the frying size.

When fish or any thing else is cooked in a frying-pan with just fat enough to prevent it from burning, it is not fried but *sautêd*, there being two very distinct ways of frying. To fry means to cook fish or something else immersed in boiling fat. To *sautê* means to cook fish or something else with just fat enough to merely cover the bottom of the pan; for instance, small fishes are fried, but omelets are *sautêd*; potatoes are fried, but parsnips are *sautêd*.

Many inexperienced cooks make mistakes on that account; they read in some cook-book that such article of food is good fried, and set to frying it when it should be *sautêd*, and *vice versa*.

The fat skimmed from the surface of broth, which is beef-suet, the trimmings of steaks or roasting pieces of beef melted as directed below, are better for frying purposes than lard, not flying all over as lard does.

The fat skimmed from trimmings or from around the kidneys of beef is cut in small pieces, put in an iron pot, and set on a rather slow fire. As soon as it begins to melt, ladle off the melted part and turn it into a stone or crockery jar, which you cover when cold. Put it away in a cool, dry, and dark place. A careful cook never needs lard for frying purposes, but has always more fat than is necessary out of boiling or roasting pieces, and that skimmed on the top of broth, sauces, and gravies. Some cooks will not take the trouble to melt it when the mistress allows as much lard and butter as is asked for.

It is an error to believe that by using much fat to fry, the articles fried, will taste greasy; if there is not fat enough in the pan to completely immerse the objects fried, they will certainly taste greasy. It will be the same if the fat is not heated enough. It is heated enough when jets of smoke ooze out of it, or when, on throwing drops of water on its it makes a crackling noise.

When the fat is hot enough, the article that is to be fried is dropped into it, and stirred gently now and then with a skimmer. When done, it is taken off the pan with a skimmer and turned into a colander, which should rest on a dish or bowl to receive the fat that may drop from it.

If the article to be fried is not completely immersed in the fat, the part not immersed will absorb fat, and, as stated above, will be greasy; but if there is fat enough to cover it entirely, the intensity of the heat closes the pores, carbonizing the exterior of the article, as it were, and preventing it from absorbing any fat.

If the articles to be fried be tender and somewhat brittle, they are put in a wire basket or perforated double bottom made for that purpose, and the basket is plunged into the fat. The basket is raised when the articles are fried, and held over the pan to let the fat drop; they are then taken carefully out of it, placed on a dish, sprinkled with salt, and served hot.

When the frying is done, the pan is put away for a few minutes, to allow the particles of solid matter that may be in to fall to the bottom of the frying-pan; then it is turned into the jar, gently and slowly, so as to retain those particles in the bottom, and it is put away for another time. *Prof. Pierre Blot in To-Day.*

"Quinces," in the *Gardeners' Chronicle*, gives the following recipes, which may be useful to many in a season of cheap fruit:—

Quince Jelly.—Wipe the quinces carefully, then cut them in slices lengthwise, without removing the skin. Take out the pips (I should say leave them, but so it is written in the original document, which has led to excellent results). Throw these slices, as you cut them, into cold water in a stewpan which is not tinned, because tin blackens fruit preserves, jams, and jellies. There should only be just enough water to cover the sliced fruit. Set the stewpan over a brisk fire. When they are boiled quite tender pour out the contents of the stewpan into a sieve set over a broad pan, and let the juice drain completely away. Add to the juice an equal quantity, by weight of lump sugar and set it again on a brisk fire. Let it boil until a teaspoonful of the juice poured on a plate, and set in a cool place, will turn to a firm jelly; then put it into pots. The fruit which remains in the sieve after being drained makes excellent quince-paste cakes.

Preserving Meat from Flies.—Sprinkle some pepper over it, and flies will not go near it. Proved.

Preserving Meat from Flies.—Nothing can be applied to meat for the purpose without at least altering its flavour, and of all things the least objectionable is pepper; pepper well, and scrape off when about to be used, or mix well 2 oz. of ground black pepper, 4 oz. of sugar, and 1 pint of infusion of quassia chips, and place in shallow dishes about the meat, taking care to spill none on it. Carbolic acid (a poison by the way), if sprinkled upon a table-cloth or near meat, not on it remember, will keep away flies, and be useful in other ways beside. Belgian butchers use laurel oil or door-posts and window-frames with such effect that every fly skedaddles in disgust.

Scars.—With time, the redness of the scar will diminish. Avoid all irritation of the parts. Should any more glands show any tendency to suppurate, "E. F." should have them injected with acetic acid. This will cut short the suppuration, and render the use of the lancet unnecessary, and thus "E. F." will be saved from having any more scars.

Scars.—To obscure, boil in 3 quarts of water 1 pint horse-radish, 4 oz. pulverized alum, and 4 oz. rock salt. When cold, wet pieces of thick lint therewith, and apply frequently. This will harden and thicken the skin. Persevere for some time, and the effect is certain. On going among friends, dull the shiny appearance by bathing it with a little spirits of hartshorn in water. The first-named preparation is best when made newly; it gradually loses pungency and effectiveness, and so when weak must be renewed.

Yeast for Country Use.—The best yeast is the German, prepared thus.—Three kinds of grain are used. Indian corn, barley, and rye, all sprouting, are powdered and mixed, and then macerated in water of temperature 65° to 75° C. In a few hours saccharification begins. Then the liquor is racked off, allowed to clear, and alcoholic fermentation set up by adding a minute portion of ready made and fresh yeast. As fermentation progresses, the globules of yeast reproduce themselves, carbonic acid is disengaged with great rapidity—globules of yeast are thrown up by the gas to the surface, where they form a thick scum. This scum is carefully removed, drained, and compressed, and then constitutes the best and purest yeast known; it keeps eight to fifteen days, according to season. If you fancy something simpler, read this receipt for potato yeast:—Grate three large raw potatoes on a coarse grater, pour boiling water on the mass of pulp enough to make a clear, thick starch, add half a cup sugar and quarter cup salt. When lukewarm add one cup yeast, keep warm until it rises. A cup of this yeast will raise seven large loaves of bread, and it keeps good four or six weeks. Boil a handful of hops in the water before pouring over the potatoes and the yeast will keep two months and over in hot weather. Milk make a good yeast prepared thus:—To a pint of new milk put a teaspoonful of salt, stir well, and keep it lukewarm by the fire; in an hour or so it will be fit for use. Twice as much must be used as of common yeast. The bread dries soon with it. This is convenient in summer. If this yeast turns sour throw it out, as it is useless then, and lastly, there is an interesting receipt for bread without yeast, culled from a paper and tested:—Bread without Yeast. Scald about two handfuls of Indian meal, into which put a little salt, and as much cold water as will make it rather warmer than new milk; then stir in wheat flour till it is as thick as a family pudding, and set it down by the fire to rise. In about half an hour it generally grows thin. You may sprinkle a little flesh flour on the top, and mind to turn the pot round that it may not bake the side of it. In three or four hours, if you mind the above directions, it will ferment as if you had set it with hop yeast. When it does, make it up in soft dough, flour a pan, put in your bread, set it before the fire, covered up; turn it round to make it equally warm, and in about half an hour it will be light enough to bake. It suits best to bake it in a Dutch oven, as it should be put into the oven as soon as it is light. These yeasts answer for all ordinary purposes. In fancy bakings use discretion as in many such no yeast whatever is used. We have other receipts for yeasts, also baking-powders, some of the latter very excellent. Do not use yeast after it grows stale; neither keep it in a tin or metal vessel. Follow out carefully, and you will have reason to be thankful.

Vegetables. These should never be washed until immediately before being prepared for the table. Lettuce is made almost worthless in flavour by dipping it in water some hours before it is served. Potatoes suffer more than any other vegetables through the washing process. They should not be put in water till just ready for boiling.

A Patent Overhead Sewing Machine. — A real overhead sewing machine has been invented by Mr. James Laing, of Dundee. The feature of the invention is the action of the needle which is made in a cylindrical spiral form, or similar to a cork-screw spring. This needle has several convolutions. As usual, one end is pierced to enter the cloth, the other being constructed to hold the thread. Just in front of the eye the needle is slightly enlarged so as to somewhat widen the hole through the fabric, and prevent the hooked eye from catching upon it. Two methods of working the machine have been patented — that in which the thread is required to be cut in lengths of about 27 ft. and doubled in order that the needle may be threaded by the self-action of the machine, and that by which this doubling is done by the machine, so that the thread can be used directly from the spinner's bobbin. The work of bag sewing can be accomplished, it is said, at the almost incredible speed of 1,000 stitches per minute, and, as in sack-sewing, three stitches go to the inch, 333 in. or 9¼ yards of cloth can be sewn in a minute.

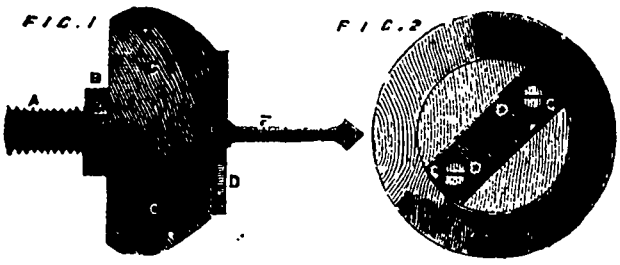
Ill Temper.— A single person of sour, sullen temper—what a dreadful thing it is to have such a one in a house! There is not myrrh and aloes and chloride of lime enough in the world to disinfect a single home of such a nuisance as that; no riches, no elegance of mien, no beauty of face can ever screen such persons from utter vulgarity. Ill temper is the vulgarist thing that the lowest born and illest bred can ever bring to a home. It is one of the worst forms of impiety. Peevishness in a home is not only one of the greatest sins, but it can introduce the deepest permanent misery in the very temple of love.

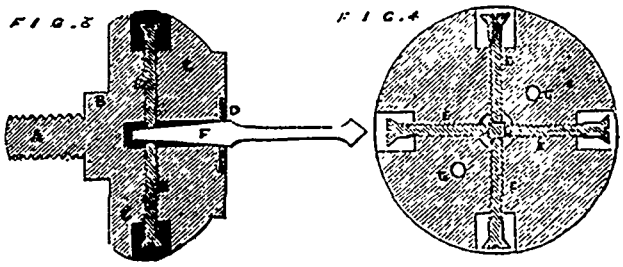
Apple Jelly.—Peel and cut your apples into thin slices lengthways, rejecting the cores. As fast as you do this throw them into cold water, to prevent their turning brown. Set them on the fire in a stewpan, with just enough of this same water to cover them well. If you like, add the juice of two or three lemons for every fifty apples. The whole of this operation should be done as rapidly as possible. When they are quite soft and yielding to the pressure of the finger take them off the fire, and put them into a very clean sieve or a new flannel jelly-bag, to drain into an earthen pan, but without squeezing them. Pass the juice through the bag till it is perfectly clear, and add to it an equal quantity of sugar broken into small lumps. Let it boil until the juice hangs about and clings to the skimmer with which you stir it. Pass it once more through the sieve or a small-holed cullender. Throw in exceedingly thin slices of candied citron peel, and put into pots. Pippins are usually employed for this purpose, but many other apples can be used, provided they are not woolly and dry. Apple marmalade may be made with the residue. The jelly is firmer when only three-quarters the quantity of sugar is used, but is darker in colour. Pear jelly may be made in the same way.

New Mode of Making Bolts Nuts.—An American has invented a new method of manufacturing nuts, which is well spoken of by American journals. Puddled bar is rolled into the required shape to make a hollow pile, by forming two sides with top and bottom of half circle, octagonal or hexagonal, exterior or hollow faggot, just as may be desired. This pile is heated in the usual manner, and before being given to the rolls, a mandril is introduced into the exterior or hollow of the pile, which mandril is held in position by being attached to the end of a rod or chain, the other end of which is supplied with a collar which falls behind a notched rest or brace which holds the mandril in place as the pile is introduced to the bite of the rolls and passes through them. Thus the exterior of the bars and the interior are formed at the same time, and the weld completed. The further reduction and finish of the bar is accomplished by a repetition of the manipulation in the successive use of smaller mandrils and smaller grooves in the rolls. Then, before the bar has lost the heat, it is given to a gang-saw, and by one movement cut up into blanks of the required thickness, of exactly uniform size and weight, ready for the reamer and milling and chamfering machine. It is claimed that nuts can be manufactured much cheaper by this process than by the old methods; they are stronger, and consequently can be lighter, and thus more of them obtained from a given weight of iron.

Smelling Salts.—Carbonate of ammonia in powder. Keep in a stoppered bottle, and add a drop or two of liquid ammonia to increase its strength, and also a few drops of scent of any description to render it more pleasant. I had a bottle in which I used to put a few drops of every scent that I met with, and at last had such a smelling bottle that would (as the Yankees express it) "lick creation."

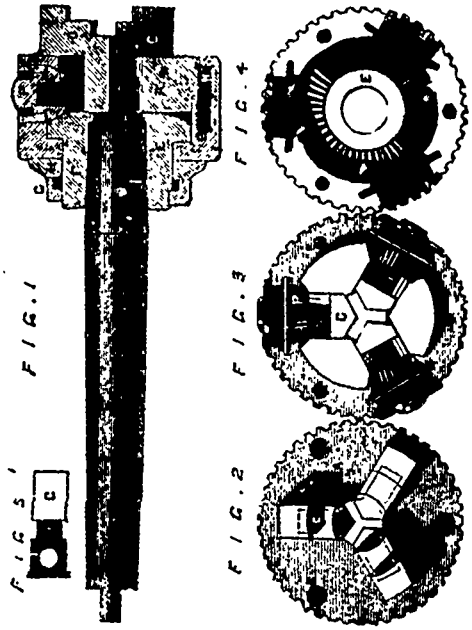
IMPROVED CHUCKS FOR HOLDING DRILLS AND TOOLS.

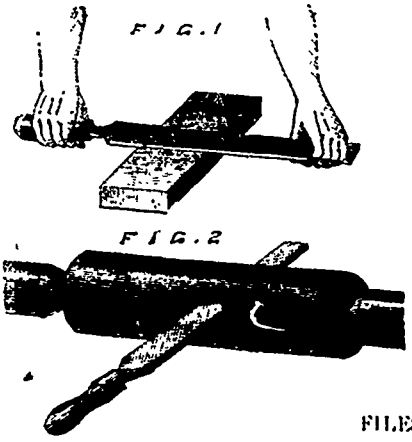


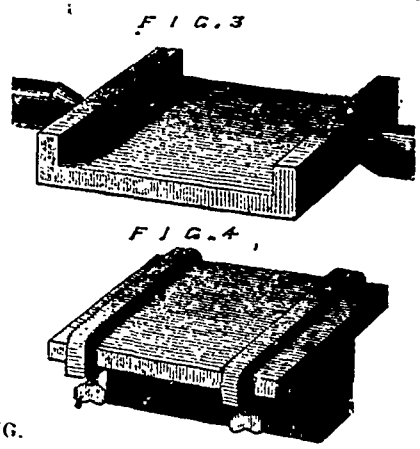


CHUCK FOR HOLDING DRILLS.

IMPROVED CHUCK FOR HOLDING DRILLS.

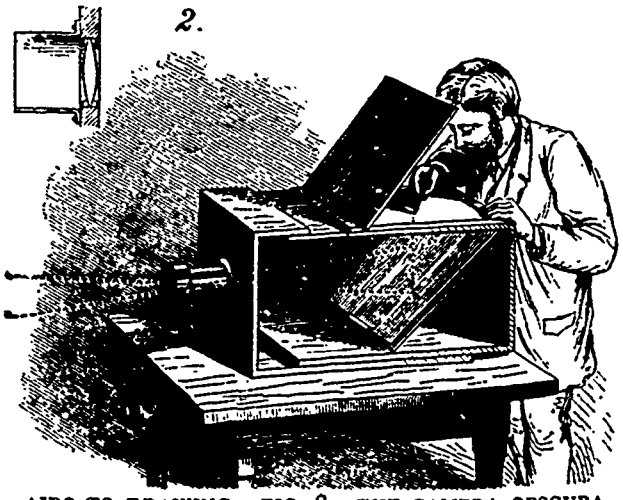






FILES AND FILING.

METHOD OF IMPROVING SPOILED BUTTER.



AIDS TO DRAWING.—FIG. 8.—THE CAMERA OBSCURA.

AND

MECHANICS' MAGAZINE.

INDEX TO VOL. III.

Those marked with an Asterisk are accompanied with Illustrations.

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