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SCIENTIFIC CANADIAN

MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

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AGRICULTURE.

THE INEXHAUSTIBLE MINE OF WEALTH TO EVERY NATION.

WHEN, at any period of its history, a nation, from any cause, has arrived at such a state of commercial depression that thousands of her people are almost in a starving condition; when the doors of her foundries, machine shops, mills, and manufacturing establishments are closed in cities and towns in which the unemployed mechanics—whose daily food, and that of their wives and children, depend upon these being in operation—form the bulk of the population; when her industries are suspended, her trade paralysed, and her markets glutted with over-manufactures and over-importations—and no one to purchase these—no foreign market to which she can export her manufactured goods, because almost every country is suffering from a like crisis in its affairs, or has guarded itself by a girdle of protective tariff—then her statesmen and her people must look around among themselves for a remedy, and both by legislative action and mutual co-operation, find out and adopt the surest and quickest method to bring about relief to her suffering population.

The causes that for the last four years have been gradually sapping the apparent prosperity of the country, were fully entered into in a leading article in last November's MAGAZINE, and may here be summed up in a few words, viz.—*over manufacturing, over importation, and over credit.* *

When we speak of apparent prosperity, we mean that no country is in a positive prosperous condition which is suddenly elevated by any extraneous impetus or circulation of money among its people, which leads to speculation and extravagant habits, and leaves them, when the wave subsides, in a worse condition than before. When that condition arises as the result of a forced or hot-house growth, and not from a gradual increase of wealth arising from a healthy stimulant in her trade and in all her manufactories, caused by the normal demands of commerce and the moderate requisites of the people, a powerful reaction is sure to follow.

Before the construction of the Grand Trunk Railway, the bulk of our population were agriculturists; our manufactories were limited in extent, but sufficient, at the time, for the wants of the people, and their wants were then but few. But when our great railroad scheme was inaugurated and carried into effect, in connection with the Victoria Bridge, it brought, not thousands, but millions of dollars, all foreign capital, into the country, which was scattered broadcast through it, and when these great works were completed, Canada saw herself almost a century in advance of what she was six years before. Manufactories had started up in every city and town; towns sprung up in a few short years where the forest before had stood; and splendid stores and dwellings were erected, before which still stood the giant stumps of the primitive forest. From this state of transient prosperity there came a great reaction; many doubtless had, by prudence and judgment, acquired much wealth; but much distress existed among that portion of the population that had abandoned their agricultural pursuits for railway construction and other employments. Soon after this came the American civil war, which gave a fresh impetus to our declining industries. Not only then did our factories, to a very great extent, benefit by that unhappy strife, but thousands of Southerners, bringing with them what means they had saved from the wreck of their fortunes, sought refuge on our soil—not as paupers, but as benefactors to a much greater extent than was generally supposed; for, in the year 1867, after the war had ceased, there were 1,100 houses to let in the city of Montreal alone, which was caused by the return of Southerners to their own country. During that period thousands of the unemployed in our cities and towns found work waiting for them across the border, and were paid the highest rate of wages ever given before on this continent. Masons and bricklayers

* NOTE.—The withdrawal of the troops from Canada was also a loss to the country of an annual expenditure of over a million pounds sterling.

received from $5 to $6 per diem; carpenters, from $3 to $4; painters obtained fully as high rates; and Boston and New York grainers could make from $10 to $15 a day upon job work. In the cotton factories, girls received according to the work performed, varying, for inferior hands, from $1.50 to $2 per day, whilst English factory girls could double these rates; and even children 14 years of age were paid 50 cents per day for six months in the year. The sons of well-doing Canadian farmers threw down the spade and flocked to the American cities, where there was employment for all; no matter how poor a man's capacity might be, he was wanted for some kind of labor—when every man whom the United States could claim as a soldier, had to fill up the ranks of the Northern army. Here then was a source of employment, for six years, to a large number of our people, who, from that source, were not only able to accumulate money, but to send considerable sums home to their friends. But if these unhappy troubles between the North and South were the cause of giving employment to a great number of Canadians, and of throwing a large amount of American capital into this country, it had, on the other hand, its drawback; for at the same time it drew off a great many young men from agricultural pursuits, who, in American cities, imbibed tastes and habits that unfitted them for the quiet and tame life of their old homes after they returned to Canada. In the States, likewise, a large portion of the disbanded American army had become vitiated from the life they had led, and when thrown out of employment, were of little service thereafter to their country, and they and their families became mere objects of charity, instead of producers of wealth by cultivating the soil.

When a nation's affairs have arrived at a state of great depression, a remedy is sought, particularly for the impoverished mechanics and laborers. In European countries the remedy suggested for such evils is generally emigration, and the United States and Canada have been the chosen fields to receive them; and so long as this continent was in a position to require agriculturists, mechanics, and laborers, they were welcomed with open arms, for the loss of population to other countries was their gain. To-day, however, matters are altogether different. The facilities for communication between the two continents have so increased as to have brought us almost to parallel positions, and it is scarcely possible for prosperity or depression to exist in either continent, without being almost immediately felt in the other. The same commercial crisis exists in one now, as exists in the other, and, consequently, we no longer want on our shores an influx of the starving poor of any foreign nation—not even from our mother country. The old adage holds good in this argument, that "charity begins at home." We have far too many poor now of our own to provide for, and who *must receive our first consideration.*

We have stated that in cases of great commercial and manufacturing depression, emigration has always been the remedy suggested and carried out; but in Canada we, under similar circumstances, have the same remedy on our own soil, and instead of encouraging the poor of other countries to flock hither, let us do all we can to help and encourage the poor and deserving of our own people to emigrate from cities and towns, in which only want and discomfort stare them in the face, and become cultivators of the wild forest or prairie lands of the West, where, by perseverance and industry, they would, in a few years, become independent for the remainder of their lives, and become, also, benefactors to their country, instead of a drag upon the community.

The Emigration Department of Canada, years ago, was very badly conducted, and the agents, who frequently were men who were appointed to the office as a reward for some political service, were totally unfit for the important positions entrusted to them; as a natural consequence, the results to this country were very poor, compared with the sum granted for the purpose; in fact we, at one time, were actually assisting immigrants across the Atlantic, to become settlers on the wild lands of the United States. There are no more important branches of the Governmental Departments than those of Agriculture and Emigration. It is through these Departments, when properly conducted, that we expect to develope the great resources of wealth that lie in the virgin soil of our vast rich forest and prairie lands.

At the present time we have, at least, 100,000 persons, or say 20,000 families, in this country, almost dependent upon charity for support, without any prospect of the construction of vast public works, or any abnormal change in the condition of our neighbours that would throw money among them and set all our manufactories again in full operation; but 20,000 families, by becoming settlers on wild lands, and judiciously assisted at the outset, would, in the course of five years, become annual purchasers of agricultural implements alone to the amount of $500,000, and their expenditure for imported or home-manufactured goods, would not be less, annually, than $800,000; whilst the surplus products sold off their farms would probably amount to more than $2,000,000, which would only be $100 for each family, which is but a very small estimate. There is no way in which a public grant of money could be so beneficially applied, and from which such certain and rich results would accrue, than that of assisting, in a judicious and systematic way, an exodus of our own unemployed people from cities and towns to the settlements in the West. Thus would a poverty-stricken class, dependent for a livelihood upon the fickleness of trade, become, in a short time, good farmers, and their condition in life, both morally and pecuniarily, improved in every respect; and thus we feel warranted in asserting that, from the soil of the land, agriculture can be made a mine of inexhaustible wealth to a nation like Canada, which has such enormous tracts of rich and fertile prairies and valleys to be disposed of on the most favourable conditions.

In our next issue we purpose continuing this subject, and will endeavour to point out how such a desirable object could be effectually carried into effect by the Government, or even by private companies.

VICK'S FLORAL GUIDE FOR 1879.

We have received this beautifully got up work, which is really a perfect gem in floral literature, and decidedly the best thing of the kind published. The work consists of 100 pages, one beautifully colored flower (a group of Pœonies), and 300 illustrations, with descriptions of the best flowers and vegetables and how to grow them, and all for the small sum of five cents. Every family having the least taste for the cultivation of flowers should send for the "Floral Guide."

The Guide is published by Mr. James Vick, Rochester, N.Y. State, whose nurseries are world famed.

Scientific Items.

NEW NOTES ON STRIDULATION.

According to the Science Summary, in the *Independent*, some fresh observations on the buzzing of insects have been made by J. Perez. He believes that the cause of buzzing certainly resides in the wings. In the Hymenoptera and Diptera the buzzing is due to two distinct causes—one to the vibration of which the articulation of the wing is the seat, and which constitutes true buzzing; the other the friction of the wing, an effect which more or less modifies the former. In moths of strong flight, such as the sphinges, the soft and full buzzing which these insects produce is only due to the friction of the air by the wings. This sound, which is always grave, is alone produced. It is not accompanied by the basal beatings, owing to a peculiar organization, and especially to the presence of the scales. In the dragonflies, also, in which the base of the wing is furnished with soft fleshy parts, no true buzzing occurs, but a simple rustling, due to the friction of the organs of flight. M. Perez believes that the passage of air through the respiratory orifices has nothing to do with the production of sound, as when injured or closed the buzzing goes on. When the stigmats or air-holes are stopped hermetically, as was done by Barmeister, the buzzing is only weakened, as the itsect is partially asphyxiated by the loss of fresh air. When, as Chabrier did, Perez stuck together the wings of a fly, the sound was still produced, as the base of the wing continued to vibrate and the buzzing sound to be produced. But all buzzing was stopped if, by holding the wings pressed together, over as large an extent as possible, so as to exert a certain traction upon their bases, all movements of these organs is rendered impossible. In whatever way the wings are confined, provided their immobility be incomplete, the buzzing absolutely ceases; contrary to Hunter's statement. M. Perez's observations can be readily repeated, if nice methods of procedure are followed, by observers in this country, and this vexed question be set at rest.

COLORING METALS.

A foreign paper gives the following: Metals may be rapidly colored by covering their surfaces with a thin layer of sulphuric acid. According to the thickness of the layer and the duration of its action there may be obtained tints of gold, copper, carmine, chesnut brown, clear aniline blue, and reddish white. These tints are all brilliant, and if care be taken to scour the metallic objects before treating them with the acid, the coloring will suffer nothing from the polishing. On making a solution of 640 grains of lead acetate in 3,450 grains of water and warming the mixture to 88 or 90 degrees, it decomposes and gives a precipitate of sulphuret of lead in black flakes. If a metallic object be immersed in the bath, the precipitate is deposited upon it, and the color produced will depend on the thickness of the deposit. Care must be taken to warm the objects to be treated gradually, so that the coloration may be uniform. Iron treated in this way has the aspect of bluish steel; zinc, on the contrary, becomes brown. On using an equal quantity of sulphuric acid instead of the lead acetate, and warming a little more than in the first case, common bronze may be colored of a magnificent red or green, which is very durable. Very beautiful imitations of marble may be obtained by covering the bronze objects warmed up to 100°, with a solution of lead thickened with gum tragacanth, and afterwards submitting them to the action of the precipitate spoken of above.

FOR THE POLE OVERLAND.—We read in an Eastern exchange that a party of enterprising explorers in search of the North Pole left Indianapolis on the 7th ult. They are even hopeful that in the extreme northern regions they may be able to find some traces of the long-lost explorer and navigator, Sir John Franklin and his followers. The party will proceed to the Red River of the North and descend said river as far as Pembina. From the latter place, a small steamer will carry the exploring party as far north as navigation will permit. They will then proceed as best they can to Fort York, on the west side of Hudson Bay, in about 58° north latitude. At this point they will put their boats together, carried in sections, *à la* Stanley, and launch them and push as far north as 80° before going into winter quarters. We understand that the Governor-General of Canada has received instructions from the home government in Great Britain to aid and assist the expedition in every possible way. A band of 50 tried Esquimaux trappers and fishermen are engaged to accompany the explorers. The Esquimaux are thoroughly equipped for the voyage and provided with trained dogs, sledges, reindeer, etc., and can travel at a rapid pace.

CAUTION AGAINST BASTIE GLASS.—The toughened glass of M. de la Bastie, which, upon its first appearance, created so great an interest, and not a little consternation in the glass trade, has scarcely justified the great expectations formed of it, and evidence of its unreliable character is from time to time forthcoming. Thus in the August number of the *Moniteur Scientifique*, M. J. Laurent, of Marseilles, cautions the scientific world generally, and chemists in particular, against the use of it. He considers the objects and utensils made of toughened glass to be no better than so many Prince Rupert's drops or Bologna flasks, from which they differ only by their shape. M Laurent adduces an instance where a dish made of toughened glass was used at a stearine factory at Marseilles; it suddenly broke into thousands of fragments upon being placed on the metal scale of a balance. It was then in a state of cooling down from 100° C., at which temperature it had been maintained for some time; but it had previously been in use for about a month, and its sudden destruction was entirely inexplicable, save by the theory above mentioned.

SPONTANEOUS COMBUSTION.—Dr. Hoffman has called attention to some curious cases of spontaneous ignition of hydrogen in air. The phenomenon has been noticed in factories where quantities of zinc were being dissolved in hydrochloride acid for the preparation of zinc chloride. Violent explosions took place when no flame was near; and it was eventually ascertained that the gas took fire spontaneously. It appears to be caused by fragments of very porous zinc, which, when lifted above the surface of the liquid during the violent evolution of the gas, and so brought in contact with hydrogen and air, act just as spongy platinum would do under the circumstances. The author recommends the performance of such operations in the open air. The ignition can be shown by treating a few kilogrammes of finely divided zinc with acid. The "zinc dust" may even ignite by contact with water.

THE BRUSH MACHINE IN A COTTON-MILL.—Mr. Charles P. Brush, inventor of the Brush dynamo-electric machine, has completed and exhibited apparatus for a New England cotton-mill, which gives eighteen lights of two thousand candle-power each, a fourteen-horse engine being used to furnish the power. The lights are claimed to be under perfect control, and not disturbed by accidents to one or more in the circuit. The carbons in each lamp, it is also claimed, cost seventy-two cents, and last eight hours. This is about one-sixth the cost per candle-power of the Jablochkoff lights in the streets of Paris, which, however, cost more than the gas-lights they displace.

REMEDY FOR COLOR BLINDNESS.—*La France Médicale* states that M. Delbœuf has found that if a person afflicted with Daltonism looks through a layer of fuchsine in solution, his infirmity disappears. A practical application of this discovery has been made by M. Joval, by interposing between two glasses a thin layer of gelatin previously tinted with fuchsine. By regarding objects through such a medium all the difficulties of color blindness are said to be corrected.

IT IS stated that the electric light is already in use on the Crown Prince Rudolph Railway, in Austria, as a headlight. The apparatus used consists of what is known as Schnkert's dynamo-electric machine, a small three-cylinder steam-engine and an electric lamp. It takes very little room on the locomotive, and is said to answer the purpose perfectly.

A NOVELTY IN FIREARMS.—A Spaniard, of Madrid, has invented a novelty in revolving firearms. In consists in the addition of a special chamber for receiving from the rear end of the cylinder, a portion of the gas resulting from the explosion of the cartridge, and conveying it to one of the discharged chambers to expel the empty shell.

LARGE FUNGI.—Among noteworthy specimens seen at the recent Edinburgh Fungus Show was a *Polyporus giganteus* three feet six inches in diameter, and a puff-ball (*Lycoperdon giganteum*), fifty-four inches in circumference and weighing twenty pounds.

IMPERVIOUS RUBBER TUBING.—It is asserted that India rubber tubing may be made entirely impassable to coal gas by painting it over with a solution of silicate of sodium, otherwise known as "water glass."

VIENNA BRONZE WORK.

Fine Arts.

VIENNA BRONZE WORK.

Great exertions were made by the Austrian manufacturers, not only to make a fine display at Vienna, but also to carry off at Amsterdam the special prizes offered by the Dutch authorities for the best designed articles admitted to the international competition.

One of the finest examples of M. Hollenbach's work, a flower vase in gilt bronze, is shown in the accompanying engraving.

PLASTER OF PARIS.

Plaster of Paris may be made to set very quick by mixing it in warm water to which a little sulphate of potash has been added. Plaster of Paris casts, soaked in melted paraffine, may be readily cut or turned in a lathe. They may be rendered very hard and tough by soaking them in warm glue size until thoroughly saturated, and allowing them to dry.

Plaster of Paris mixed with equal parts of powdered pumice-stone makes a fine mould for casting fusible metals; the same mixture is useful for incasing articles to be soldered or brazed.

Casts of plaster of Paris may be made to imitate fine bronzes by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish, and dusting on fine bronze powder when the mastic varnish becomes sticky.

The best method of mixing plaster of Paris is to sprinkle it into the water, using rather more water than is required for the batter; when the plaster settles pour off the surplus water and stir carefully. Air bubbles are avoided in this way.

How to Clean Engravings.—Soak the print in cold water till all creases are out and it lies quite smooth; then put into a dish containing a solution of chloride of lime with twice its quantity of clear cold water. When the stains have disappeared, put the engraving into plain water, and afterwards dry with blotting paper. For the solution referred to put half a pound of chloride of lime into a vessel with one pint of water; let it stand, stirring it now and again, for 24 hours, and then strain it through fine muslin till quite clear, when the liquid is to be added to one quart of water. The prints should not be left in the solution longer than is necessary to remove the stains, and the more thoroughly they are washed in cold water afterwards the better for them, for it is liable to rot and destroy it. The wet print requires care in handling.

A VASE.—A SPECIMEN OF HIGH ART EXHIBITED AT THE PARIS INTERNATIONAL EXHIBITION.

Designers and carvers will appreciate the elegant designs illustrated on this and the preceding page, from which many an intructive lesson may be gained.

Engineering, Civil & Mechanical.

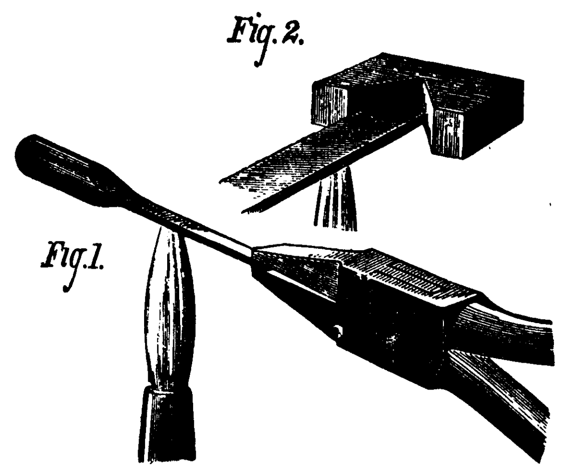
DRILLS AND DRILLING.

An ordinary flat drill for most purposes will answer nearly, if not quite, as well as a twist drill. It is not a difficult matter to make them, since we have such reliable material as Stubs' steel wire of every size. The best form of flat drill for general purposes is shown in Figs. 1, 3, and 4. It is made by milling or filing the opposite sides of the wire, so as to form a bit or blade having a thickness equal to about one fourth of the diameter of the wire. The angle of the point should be 90°, and the angle of its cutting edge about 45°, for most uses. For a drill of very hard substances, these angles may be more obtuse.

Having formed the drill, it should be hardened by heating it to a low red and plunging it straight down into cool (not cold) water. In case of a very small drill, it may be held in the flame of a gas burner or lamp in a pair of spring nippers over a vessel of water. When it attains the required degree of heat it may be dropped into the water.

To temper for most cases, the drill, after being brightened on an emery wheel or piece of emery paper, is heated; if it is a small one, in an alcohol or gas flame, until its color at the point runs down to a brownish yellow verging on a purple. If the drill is very large it may be heated over a forge fire, or over a heavy piece of red hot iron. If the drill is a very small one, it may be hardened and tempered at one operation by heating to a low red heat and plunging it immediately into a piece of bees-wax.

If it is desired to have the point of the drill very hard, without being liable to breakage, its temper may be drawn by holding its point in pliers, as shown in Fig. 1, while the main portion is held over a gas flame. The cool jaws of the pliers prevent the point from becoming heated.

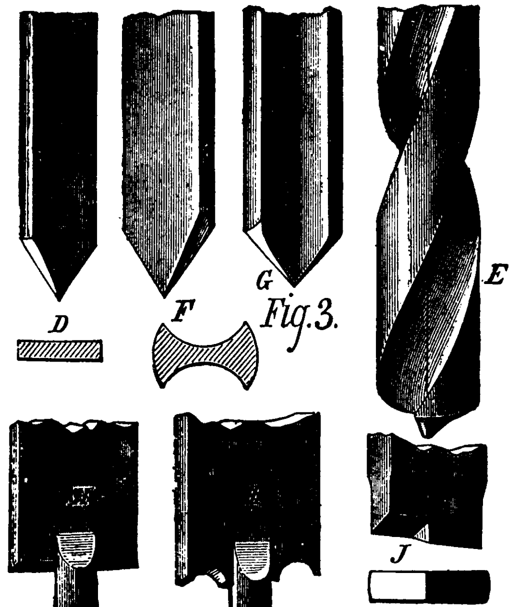


TEMPERING.

Another method, applicable to larger drills, is to employ a notched block of lead, as shown in Fig. 2. The drill in this case is driven a short distance into the lead before it is hardened; then as it is tempered, it is replaced in the lead to preserve the hardness of the cutting edges while the temper is drawn in the other portions.

When a drill is hardened by immersing its point in mercury instead of water, it acquires a diamond-like hardness. The point of the drill just described is shown in perspective and in section D in Fig. 3. The drill F is similar to the drill D, the point of difference being a half round groove along each face adjacent to the cutting edge. This device gives the cutting edge a more acute angle, which is desirable for some kinds of work. G is a straight drill having concave or fluted sides, and E is the well-known twist drill. The drills, G E, are shown in cross section in the central figure. Twist drills of recent manufacture have a central longitudinal line, which locates the point in grinding.

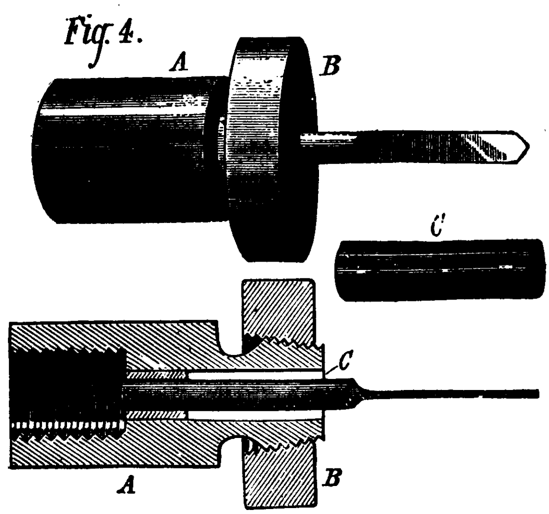
The best rule for grinding twist drills is to preserve, as nearly as possible, the original form. The ordinary pin drill H is used for counterboring, a hole being first drilled to receive the pin. The drill I is employed to give an ornamental appearance to plates in which pivots or small shafts are journaled, as in clock work. The bottoming drill, J, has three cutting edges, one upon each side, and a central transverse one connecting the other two. This drill, as its name indicates, is designed to make a flat bottom in a drill hole.



FORMS OF DRILLS.

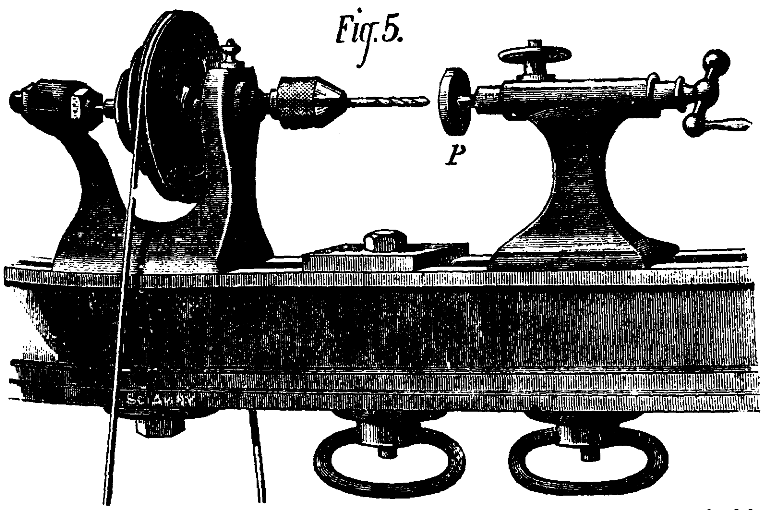
The pin drill, K, which is shown in side and end views in Fig. 6, is first carefully turned and afterward milled with the rose bit L, producing the cutting points or lips which are afterwards beveled with a file. This drill is used for boring large holes in sheet metal, a small hole being drilled first to receive the pin. M is an expansion drill for the same purpose; its construction will be readily understood from the engraving. The spindle is mortised to receive the tool carrying arm, which is secured in the mortise by a key. The lower end of the spindle is bored to receive the drill, which also forms the pin for guiding the cutter.

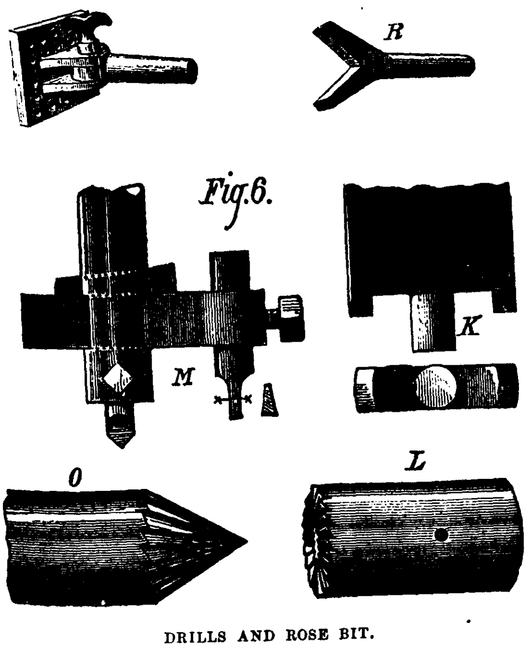
While universal chucks are recommended for holding drills, another form of chuck, shown in Fig. 4, may be used with equal advantage. It consists of a main portion, A, which screws on the lathe spindle, and has a tapering threaded end for receiving the milled nut, B. The threaded end is split to admit of its contraction as the nut, B, is screwed on. The part A is bored longitudinally to receive sections, C, of iron or steel rod. To prepare this chuck for holding drills, the pieces, C, are inserted in the chuck, centered with a pointed tool, and are drilled with



DRILL CHUCK.

the drill with which they are intended to be used. They are then split longitudinally with a saw for about three fourths their length. The pieces C, when once prepared, will always answer for the same sized drill; they may also be used with an ordinary chuck having a set screw.





DRILLS AND ROSE BIT.

The fluted countersink, O, may be classed among the drills; its special application is to form the centers of articles to be turned. It has the same forms as the lathe centers, and makes a truly circular conical hole, providing the number of flutes or cutting edges is odd.

Every lathe should be provided with a plate, or drill rest, P, fitted to the tail spindle, for supporting plain work while drilling it. The lathe should also have a hinged or pivoted rest, Q, which may be clamped at any desired angle for drilling irregular work. This plate should have several perforations for receiving pins, for preventing the work from slipping. For supporting cylindrical objects to be drilled transversely, a fork, R, is inserted in the tail spindle.

As to the matter of drilling, little need be said, as nearly everything must be learned by experience; however, a few points may be mentioned. The work should be carried forward with a regular and not too heavy pressure. The speed of the drill will vary with the material being worked. For steel, wrought iron and copper, the speed should be slow; for brass and cast iron, it may be quite rapid. In drilling steel or wrought iron, oil is the best lubricant for the drill; in drilling glass, the drill should be wet with turpentine, to which gum camphor has been added; the drill may be used dry in drilling brass and cast iron.

A Ball Safety-Valve.—A recent English invention has for its object the adaptation and application to steam-boilers of an entire ball, for the purpose of a safety-valve for the escape of steam as required, such valve being capable of being moved repeatedly, so as to present a fresh face to the seating, and thereby economize the use of the valve. And his invention consists in the use of a ball made of brass, or other suitable material, resting on a seating of steel or other suitable metal or substance harder than that of the ball, and pressed down as required on to the seating by means of a weighted frame capable of swinging freely on the ball. This ball is sufficiently large in diameter to admit of its being moved a number of times on its seating, so as to present each time it is moved a fresh face to the seating, no one face intersecting another. The ball may also be moved at convenient intervals before being worn on any one face. The valve or ball is weighted with ordinary dead weights, but the frame by which the weights are suspended, instead of being fast to the valve, as usual, is made to swing freely on the ball at the top by means of a center piece of suitable concave form, lined with soft metal or other suitable material, to prevent injury to the ball.

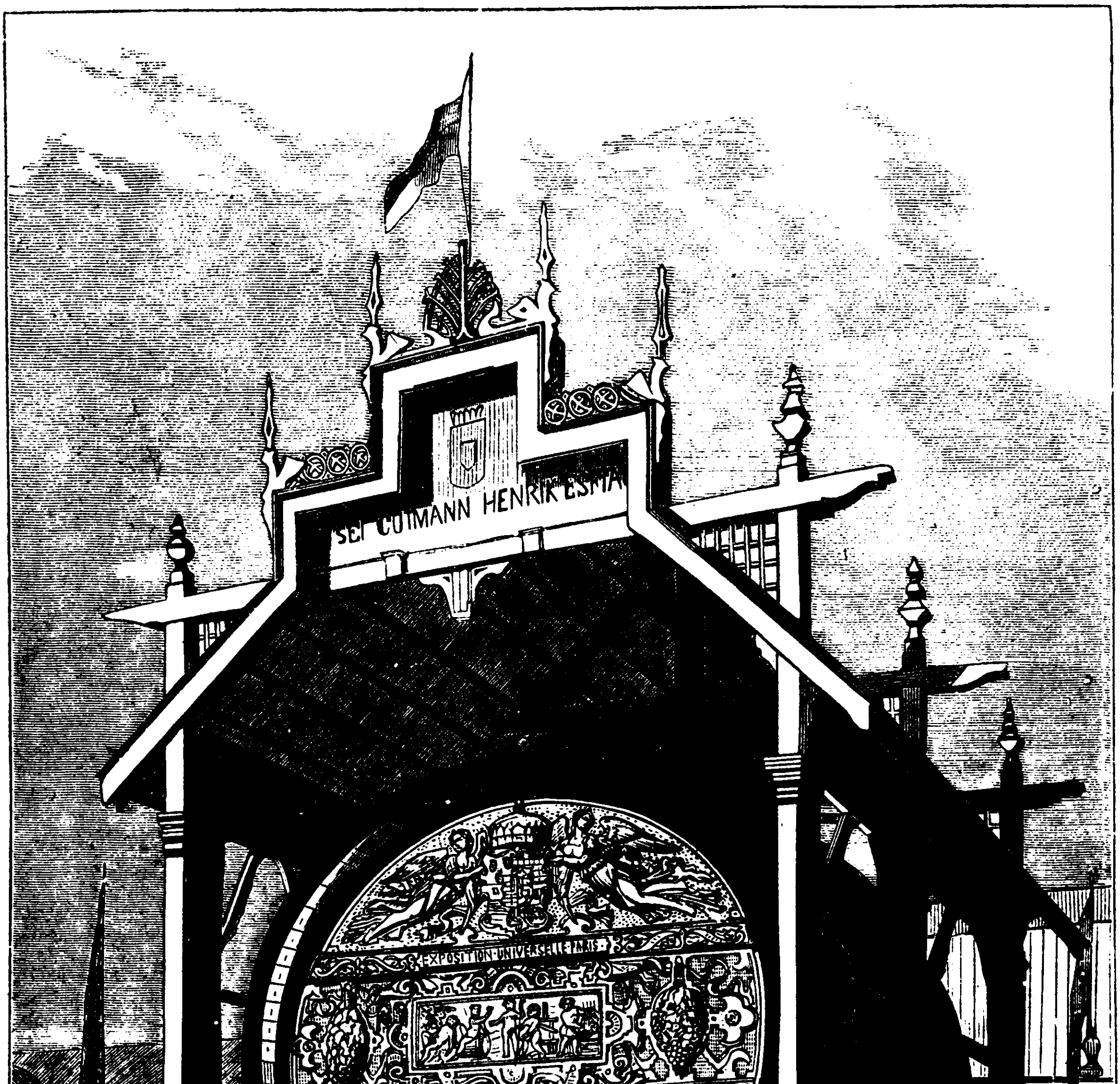
Iron Galvanizing Furnace.—In galvanizing iron the main point to ensure a uniform coating of zinc is the maintenance of a thin bath of metal. Unfortunately the zinc absorbs iron, thickens, and as the temperature must be rapidly raised, when it does so this absorption goes on increasing until the metal is unfit for further use. This is aggravated by the fact that the metal is melted in cast or wrought-iron vessels heated from below. *Iron* says that in order to avoid the disadvantages of iron vessels, and yet retain ample working space above the surface of the metal, F. A. Thum, of Laubach, Germany, has constructed a furnace resembling somewhat a reverberatory furnace. It has a fireplace and a chimney at each end, the part of the hearth connecting the two being arched over. The rest of the rectangular hearth is perfectly open above, so that the heat-conducting power of the metal is relied upon to keep it at the proper temperature in that part of the hearth. The slabs of fresh zinc are introduced through doors communicating with the hot ends. The staying of the furnace has to be very strong, in order to prevent any accidents to the arching over the ends of the hearth.

Babbit Anti-Friction Metal.—This metal is made of 1 part copper, 3 parts tin, 2 parts antimony and 3 parts more tin are added after the composition is in the molten state. This composition is called hardening, and when the metal is used for filling boxes, 2 parts tin are used to 1 of hardening. The above alloy constitutes the best anti-attrition metal in use, but on account of its expense it is very little used.

Dynamite and Water.—It has recently been shown that if dynamite is poured into water, the sand falls to the bottom and the nitro-glycerine floats on the surface, and explodes with its usual violence if the temperature is slightly increased. This will explain the cause of many of the serious explosions with dynamite when used in wet holes.

All Steel Bridge.—The *American Manufacturer* says:—The new steel bridge which is being erected for the Chicago and Alton Railroad over the Missouri River at Glasgow, Mo., is to have five spans, and is to be entirely of steel made by the Hay process. Not even a nut is to be made of iron. This is believed to be the first large bridge ever built in which steel alone is used.

"Slag wool," produced, as a fine fibre of silica, by blowing steam through the slag of the iron furnaces, has been woven by Messrs. Jones, Dade & Co., into strips and sheets. This non-conducting substance can now, therefore, be very generally applied for clothing boilers or the conducting steam pipes of machinery.



THE GREAT HUNGARIAN WINE CASK AT THE PARIS EXHIBITION.

THE GREAT HUNGARIAN WINE CASK.

The great cask of Heidelberg contained 140,000 liters of wine. At the Paris Exhibition of 1878 one was exhibited which is nearly as large, having a capacity of 100,000 liters. The great cask has been sold to a Frenchman, for whom it was made by Mr. Gutmann, of Nozy Kanizsa. It measures 3·65 meters in diameter and 4·30 meters in length.

The staves, which are oak planks from the forests of Hungary, are of 20 to 25 centimeters in thickness, and are held together by 18 iron hoops, the ends of which are firmly riveted together. The door is fastened by a system of screws, and closes the cask, and is similar to manhole covers in boilers. The cask is supported by five logs, each of which is derived from an oak perhaps a thousand years old. This immense cask, with its appendages, would furnish wood enough to stock a small wood yard. It is varnished, and the end in which the large bronze faucet is inserted is carved like a piece of fine parlor furniture. The lower part is laid out to resemble stone masonry. On the left hand side there is a motto praising perseverance and diligence; an escutcheon on the right hand side bears the date 1878. The middle portion of the head is beautifully carved, containing in its centre a group drinking and distributing wine. The upper portion bears the Hungarian crown above the Hungarian escutcheon.

This large cask has become the property of a manufacturer of champagne, of Epernay, Mr. Mercier. He will use it for fermenting and storing his wine.

Patent Inventions.

ROOM FOR INVENTION.

We frequently hear the remark that the time will soon come, when the course of invention will be run; when, like Alexander, inventive genius will weep because there are no more worlds to conquer. The fact that iron fingers have in so many branches of industry been made to perform tasks once done by bone and sinew; that electric throbbings have outstripped the fleet messenger in business affairs, and the iron horse with food of burning coals carries the love-letter and the meal-sack, where once the out-fed country steed galloped along the hard-beaten road—these facts are impressive and suggestive, but not convincing on the subject of an ultimate limit to inventive usefulness or inventive power. The ball of progress in rolling along has wrapped about it many a layer of ideas formed into tangible facts; but the periphery grows, and the capacity for enlargement grows with it. As the circle of knowledge widens, the illimitable space beyond still more increases, and there is both more to learn, and greater ability to learn it. If the needs of man were the sole gauge of his demands, there might well be a point at which invention, satisfied with granting all needful things, would be compelled to rest. But "to want" means both "to lack" and "to desire;" the food and shelter and clothing absolutely requisite develope into luxuries of palate and æsthetic taste. The rude needle of bone that sewed with sinew the boar-skin cloak and made of it a definite garment, was an invention that might have sufficed in its line, had the skin-garment satisfied; but demand and supply are commensurately progressive; each surpasses each, onward in the march of progress; and now we have that household companion the sewing-machine, purring like a kitten, while basting, sewing, hemming, gathering, tidily at high speed;—this modern sewing machine being as legitimately the development of the bone needle as the fashionable garment of to day is the outgrowth of the fig leaf of Eve and the skin covering of her sons.

Our wants have become artificial; with suggessive generations, luxuries develope into customary grants and eventually become necessities. Our condition is ameliorated, and hence our appreciation sharpened, while certain faculties have become dulled and invention must supply their places or their deficiencies. Where invention has produced an effect, it is for invention to extend and perfect it. Thus in every walk of life it is for cunning brain and deft fingers to effect new combinations or perfect the old, fearless of thwart or limit. In proof that with improvement criticism becomes more keen, and demands more imperative, we have only to look about us for promising fields to engage the inventor. While the harvest of golden grain no longer falls before the classic sickle, and the hay maker has ceased to be a picturesque inspiration for the poet—the root-crops still demand personal delving and grubbing, and the ripened fruits still call for human pickers to pluck them one by one. For the inventor who would devise a mode removing half the blossoms from a peach tree, without injuring the buds which form the next year's bearing stems, there awaits a magnificent prize. Ramié and other fibers still defy the textile art; and the gorgeous aniline dyes fade with a summer's sun. Household fires, once synonyms of health and cheerfulness, are now gloomy and noxious monuments of our heedlessness of things sanitary. Those domestic conveniences that should minister to our comfort and well-being, poison us insidiously but surely. Our vaunted gas-lights blacken our paint and kill our window plants, while in the street, the pipes which lead the gas destroy our shade trees. Our sewers and our drains are confounded in name and in use, and both of them are poisonous. Our chimneys breathe forth smoke which is unconsumed fuel, and hence wasteful. Our steam-boilers, with partly consumed fuel, supply our engines with wet steam, and the engines (whose cylinders have to be supplied with oil, through faulty design and workmanship) waste part of the remainder. Our horses, shod with no regard to humanity or for tractive effect, draw wagons or cars which rattle our teeth out, on roads or rails which rattle the vehicle to pieces. The explosives which long ago were constrained to throw hurtful missiles for miles, have but in one instance—blasting—been employed in peaceful work; if we may except the gun-powder pile driver, the precursor of a long line of explosive motors yet to come. There is yet no ice-machine which will satisfactorily and ecomomically compete with nature in supplying a commodity now so great a necessity. The science of aëronautics to which the veteran Wise and others have devoted so much time and skill, and which they have demonstrated to be far within the bound of safety—has not been developed from flotation to guidance—still less to propulsion. A spark of fire has terrors greater far than those of the avalanche or the glacier.

For these and hundreds of other evils, inventive genius must provide the remedy; and as new and artificial wants arise and develope into necessities, upon the inventor, ever in the vanguard, devolves the duty of exploring the land of the possible and providing for the legions of the actual.

It might be said that as science falls into the ranks of knowledge, and art after art is added to the forces of man, the field of true invention would narrow, and that of improvement, combination and application correspondingly widen. And this distinction may not perhaps be improper to draw, nor inappropriate to apply. Certain it is, that as observation and experience lay down the facts, and reason deduces therefrom the theories and evolves from these again the laws which govern things tangible and forces intangible, the plane of the inventor will rise higher and higher, and his usefulness will never diminish. It is to him that races unborn, nations unformed, countries unexplored, look for their betterment and the achievement of their substantial welfare. Through him the antagonism between man and man—the foul distinctions of caste and class—will be swept away; and better men, under better lives and higher pleasures and comforts, achieve the destiny written for them in the days when the rocky ribs of this earth were formed.—*Polytechnic Review.*

THE QUESTION OF PATENTS.

(*From* "L'Ingénieur Universel.")

Many questions were treated at the International Congress held recently at the Trocadero. Discussions took place on international relations of the laws on Letters Patent, their duration and annuities, the rights and duties of inventors, &c. In a word, it would seem that discussion in this respect had quite exhausted the subject. Many a hiatus of capital importance could be pointed out, many sides of the question have been left out at the Trocadero Congress, as well as at the various congresses and meetings held in London, Vienna, and Berlin. It is not our purpose to inquire whether the composition of the Congress, the members of which belonged for the most part to the intermediary class of patent agents, did not contribute in a great measure to exclude practical questions from the debate; but it is on these that we wish to call the attention of our readers. The actual Patent Laws are totally insufficient. In most countries the incomes accruing from the taxes imposed are far in excess of the sums expended by the various States in maintaining the libraries and museums specially affected to the use of the inventors. Well, with the exception perhaps of England and America, inventors are victims to unjust exactions, and receive no compensating help. This we will show by an exhaustive review of the whole question. What are the means at the disposal of the inventor to make sure whether his discovery is really new? This question would seem puerile to not a few inventors. The unwillingness and impatience of most of them to an examination of their pretensions are well known. They are generally too much taken up with the creation of their "genius" to admit of it in any other than an offensive light, and doubt the advice given them of making sure whether it has been patented or not in some corner or other of the civilised world. The same invention may have been made or even abandoned as too insignificant, or improved upon by some one else. Happily, there are those among inventors who are wise enough not to shrink from such a test, and to seek to inform themselves as correctly as possible, respecting all inventions of a concurrent nature. Therein lies the great difficulty. Let us take, for instance, the electric light and the telephone, two subjects which have stimulated to the utmost the genius of inventors throughout the world. Not a week passes but what some patents are applied for, and granted here and there for improvements in these two objects. Now what guarantee have these inventors, one of which lives in America, and the other in Austria or Sweden—that at the very moment they apply for their patents they may not have already been forestalled by some other competitor? The announcement on the subject does not fly through the press as rapidly as is thought. It is only when the inventions are of a nature to engross the attention of the whole world that newspapers, forced along by the current, take up and ventilate the matter. Inventors desirous of being well informed would hence make a great mistake if they relied for information on newspapers, and especially the newspapers of one country alone. The essential point for them is to be made acquainted with inventions immediately Letters Patent have been granted. But therein, as previously stated, lies the difficulty! Let us suppose in fact that the inventor of a telephone requests us to obtain for him with the least possible delay the specifications of all patents which, in every country, have been or are about to be granted on this head. How should we proceed? The following table may guide us. Descriptions of Patents may be made known to the public within the following delays:—

Canada	from	30 to 40 days.
France	"	14 to 20 "
England	"	14 to 20 "
Germany	"	30 to 100 "
Italy	"	30 to 100 "
Sweden	"	20 to 60 "
Austria	"	30 to 60 "
Russia	"	30 to 60 "
United States	"	30 to 60 "

Thus it is seen that it takes from 14 to 100 days to obtain information respecting an application for a patent. That is not excessive. This granted, how is it possible to know whether the applications have been made to the governments?

To sum up, the first reform to be demanded is that the special papers giving information on patents applied for in every country, should be found on the table of our public libraries. It is very humiliating that Paris, where libraries, museums and collections of every kind abound, should rank in as regards technical libraries, below London, Vienna and Berlin. We may be allowed to hope, therefore, that she may before long regain the rank that befits her. It is quite evident from the foregoing that the means at the disposal of inventors to enable them to ascertain what novelty there may be about their discoveries, are totally inadequate. Then again, great exhibitions are far from bringing out everything relating to each branch of industry; and it may safely be said that ideas of possible improvements, but which have not taken a practical shape, exist with respect to most of the objects thus exhibited; or that the said improvements have not figured at these exhibitions. Despite all the business transactions between nations, springing from commerce, travels, books, the press and exhibitions, rare indeed are the industries the improvements in which come rapidly to the knowledge of the public. The validity of patent rights suffer from this delay, and we should not be far out of our reckoning in estimating at 30 per cent. the number of invalid patents applied for, either in France, in England, in Italy, or, in a word, in every country where there is no preliminary examination of applications for Letters Patent. Such a sifting is done in the United States, and in Germany, with a view to diminish the number of insignificant patents; and from 20 per cent. to 30 per cent. of the applications are rejected. It must be conceded, nevertheless, that even in Germany and the United States, the officials entrusted with the duty of examining applications are liable to mistakes. It may even be confidently asserted that 30 per cent. of the patents granted, and 40 per cent. of these applied for in that country, could not stand their ground before a tribunal competent enough to decide in the matter of novelty in the would-be inventions. Hence arises immense loss, both in time and money; for what with government taxes and fees for agents, the amount paid for each patent cannot be less than 250 fr. This represents an annual loss of many millions resulting, in every country, from voidance of patents. To return to our point, the reason why so many patents are void, is that the means at hand to obtain information are insufficient; we would therefore call the attention of Governments to the following suggestions:

1. That in every country there should be a library provided with all official publications of foreign countries touching on the lists, descriptions, and drawings of patents granted; such an institution might be created, by establishing either a separate section in the local library already in existence, or a special one, like the Free Public Library at the offices of the Commissioners of Patents in London.
2. That the example of England be everywhere followed as regards her *Commissioners of Patents Journal*, which publishes a list of all the patents granted abroad, in the language of the country where they have been taken out.
3. That governments should come to an understanding to draw up their notices of patents in such a manner, as would make the searching of such records for a particular invention, in whatever country it may have been granted, a matter of a few minutes only.

Up to the present no two countries agree in the method followed for the classification of patents; precise research is therefore a material impossibility. Only when the complaints of which we have made ourselves the mouthpiece, shall have had due attention, will inventors possess adequate means to make sure of the originality of their discoveries.

Chemistry, Physics, Technology.

THE RINGS OF NEWTON.

All transparent bodies show a beautiful play of colour, when they are reduced to sufficiently thin layers. This is observed most easily in soap-bubbles and in the thin films of glass which a glass-blower produces when he expands the glass-ball he is blowing, until it bursts. The same is seen when a drop of any ethereal oil, say oil of turpentine, is placed upon water so as to expand upon it and make a very thin layer. It is also seen when a bright piece of metal, say steel, is heated for the purpose of tempering; the film of oxide formed shows colors varying with the thickness of the film. So too when a heavy piece of glass is cracked, the thin film of air in the crack will show the same appearance of various colours.

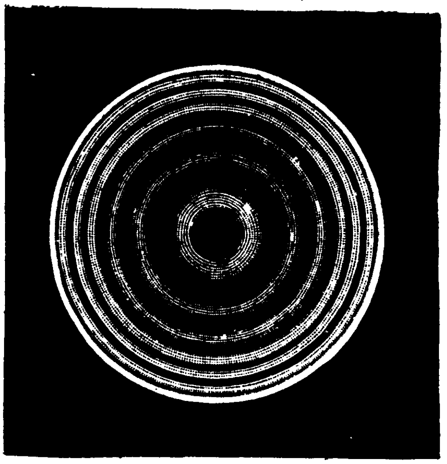
The best way to produce these colours in regular order, and the method of observing the thickness of the films producing them, was invented by Sir Isaac Newton, who, by placing a curved lens upon a flat glass table, produced coloured rings, which have been named after him—the rings of Newton. In order to do this successfully, the lens must have a very feeble curvature, or, in other words, a long focus, say from 40 to 60 feet; or a convex lens with a curvature of say 20 inches, may be laid on a concave lens of 21 inches, which gives results about equivalent to a lens of 50 feet focal length laid upon a plane surface. When pressed down by proper appliances, such as screws along the edge a series of concentric coloured rings are seen, of which the adjoined illustration gives some idea, while the following details may be observed.

In the center where the contact takes place, reflected light shows a dark spot; around this is a ring of blueish-white, then yellowish-white, brownish-orange, red, another ring of violet, blue, yellowish-green, yellowish-red; then purple-red, blue, yellowish-green, red, carmine-red; then greenish-blue, pale green, yellowish-green, red, etc.

The exterior rings become narrower and narrower, as seen in the figure, and are alternately pale green and pale red—they become more and more faint, so that as a rule only eight or nine rings can be distinguished. The details here described can only be seen when the lenses used are such as to produce large rings; when lenses of short focus, such as spectacle-glasses, are pressed upon a piece of flat plate-glass, the rings form so small a spot that details cannot well be observed with the naked eye; but then a magnifying-glass may be used and they may be thus seen enlarged.

Instead of rings, the same succession of colors may be observed in bands produced by two pieces of thin plate-glass from 5 to 6 inches long and 1 to 2 inches wide. At one end they are separated by a strip of gold leaf, at the other end they touch. When pressed together the colours appear in the regular order above described, the dark spot at the point of contact at one end, then the bluish and yellowish white, orange-red, etc., in regular succession.

Newton measured, with the greatest accuracy, the thickness of the layers producing these colours, which is very simple when the curvatures of the lenses are known. His results for the center of the first and brightest ring are embodied in the following table :—



RINGS OF NEWTON.

Name of Color.	*Thickness of the layer of Air.*
Extreme red	6.344 inches.
Limit between red and orange	5.866 "
" " orange and yellow	5.618 "
" " yellow and green	5.237 "
" " green and blue	4.841 "
" " blue and indigo	4.513 "
" " indigo and violet	4.323 "
Extreme violet	3.947 "

POISONOUS TIN PLATE.

The Boston *Journal of Chemistry*, after commenting upon the many hidden dangers that surround us in our daily life, goes on to say :—" Attention has recently been called to a new risk of chronic poisoning by the old enemy, lead. What we call 'tin' vessels—that is, sheet iron coated with tin—are in daily use in every household in the land. They are cheap, durable, and convenient, and have been considered perfectly safe for the thousand culinary purposes to which they are devoted. They *are* safe if the tin plate is honestly made ; but unfortunately this is not always to be counted upon. Tin is comparatively cheap, but lead is cheaper ; and an alloy of the two metals may be used in place of the dearer one, with profit to the manufacturer though with serious detriment to the user. The alloy is readily acted upon by acids, and salts of lead are thus introduced into food. The Michigan State Board of Health has lately been investigating this subject, having been led to do so by a letter from a physician who found that certain cases of what had been taken for chorea were really *paralysis agitans*, which could be traced to this kind of lead-poisoning. Other cases were brought to light in which children had died of meningitis, fits, and paralytic affections, caused by milk kept in such vessels, the acid in the fluid having dissolved the lead. Malic, citric, and other fruit acids are of course quicker and more energetic in their action upon the pernicious alloy. The danger is the greater, because lead salts are *cumulative* poisons. The effect of one or two small doses may not be perceptible, but infinitesimal doses, constantly repeated, will in the end prove injurious, if not fatal.

" Analysis of a large number of specimens of tin-plate used in culinary articles showed the presence of an alloy with lead in almost every instance, and often in large quantities. It is safe to assert that a large proportion of the tinned wares in the market are unfit for use on this account.

"That we may not be accused of exciting fears which may be groundless, we will inform our readers how they can settle the question for themselves by a simple and easy test. Put a drop of strong nitric acid on the suspected 'tin,' and rub it over a space as large as a dime. Warm it very gently till it is dry, and then let fall two drops of a solution of iodide of potassium on the spot. If lead is present, it will be shown by a bright yellow color, due to the formation of iodide of lead.

" It is stated by Dr. Kedzie that a peculiar kind of tin-plate, the coating of which is largely made up of lead, is coming into general use for roofing, eaves-troughs, and conductors ; and it is suggested that much of this lead will eventually be dissolved and find its way into household cisterns. Susceptible persons may be poisoned by washing in the lead-charged water, and all who drink it, even after it is filtered, are in danger of chronic lead-poisoning. There is also risk in the use of glazed earthen vessels, if, as is often the case, the glazing contains oxide of lead. The danger in the use of certain enameled iron vessels was pointed out some time ago in the *Journal;* and it is said that these poisonous wares have not entirely disappeared from the market."

ACTION OF WATER AND SALT SOLUTIONS ON ZINC.

The results of a series of experiments made upon this subject by Snyders may be given briefly as follows :—

1. Zinc decomposes salt solutions, concentrated as well as dilute, without access of air or oxygen. Hydrogen is liberated, and oxide of zinc is formed.
2. The solubility of oxide of zinc in the salt solutions hastens and aids the reaction.
3. Oxide of zinc dissolves in solutions containing but 1 per cent. of salt, or even if more dilute. The solubility in different salts is different, being greatest in ammonia salts. It seems to be due to the formation of free alkali, inasmuch as it can exist in solution with a double zinc salt at certain temperatures and by certain concentration. Zinc carbonate and hydrate are not soluble in the carbonates. The solubility of zinc oxide increases as the temperature and concentration increase.
4. If the salt solution is saturated with oxide of zinc the decomposition does not go any further, but the zinc oxide formed subsequently remains undissolved. But few experiments have been made in this direction, and others will be instituted by the same person.
5. With access of oxygen free from carbonic acid the oxide dissolves more rapidly because the zinc oxidizes at the same time. The salt aids this oxidation, not directly, but by keeping the surface clean. This, too, requires to be substantiated by further experiments.
6. The solvent action is somewhat retarded by the carbonic acid of the air, owing to the formation of some basic carbonate upon the surface of the zinc.
7. The decomposing and solvent action is greatest in the case of the chlorides and with potassium sulphate, weaker with the nitrates of the alkalies and of barium, and for magnesium sulphate.
8. Zinc does not decompose solutions of alkaline carbonates or sodium phosphate in the absence of air. With access of air but little zinc is dissolved by one per cent. solutions, because the zinc is protected by the zinc carbonate or phosphate formed by the reaction. In diluter solutions somewhat more zinc oxide is dissolved.
9. The action increases with increase of temperature ; at the freezing point of water it is very slight.
10. Solutions of ammoniacal salts take up more zinc than the solutions of the salts of the fixed alkalies. The zinc remains bright in these solutions, and nothing separates, even if oxygen or air is permitted to enter.
11. Hard well-water does not act upon zinc, even with large percentages of chlorides and sulphates. Soft water dissolves more zinc in proportion as the amount of chlorides, sulphates, and nitrates exceeds that of the carbonates and phosphates.

The poisonous nature of zinc salts, even in small doses, renders the above research of more than ordinary practical interest.

GAS TURNING THE CRANK FOR ELECTRICITY.—A report from Philadelphia of a lecture by Prof. Barker on the 13th ult. on the electric light gives some statements concerning the economy of the light as compared with gaslight, which, if true, are the most astonishing of anything we have yet seen. The *American Manufacturer* says : In the course of the lecturer's experiments, a Schleicher gas engine was used to drive the dynamo-machine. It is stated that the engine did its work well, and its operation was peculiarly interesting from the fact that the gas used in driving the engine was the ordinary illuminating gas. Of this

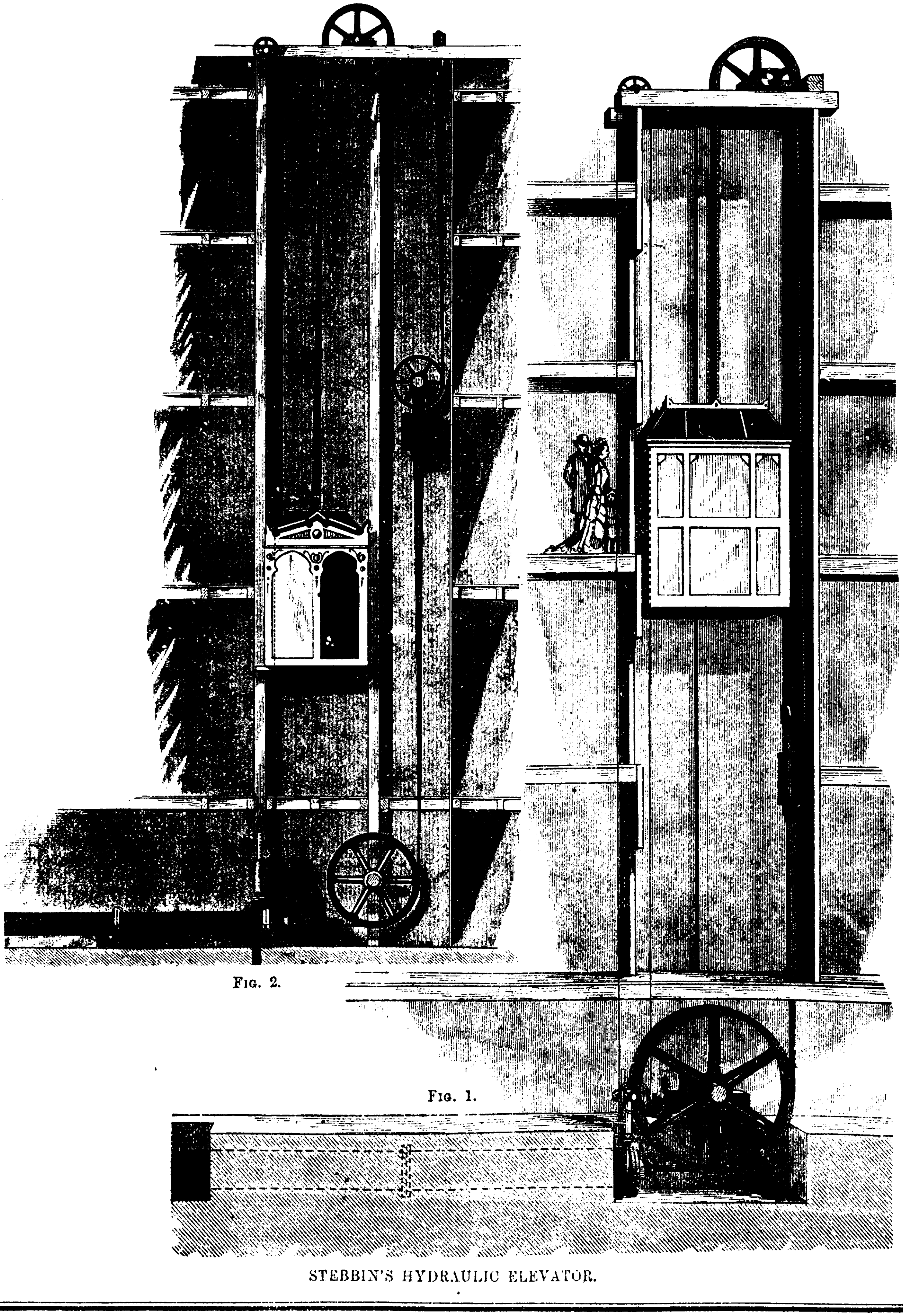
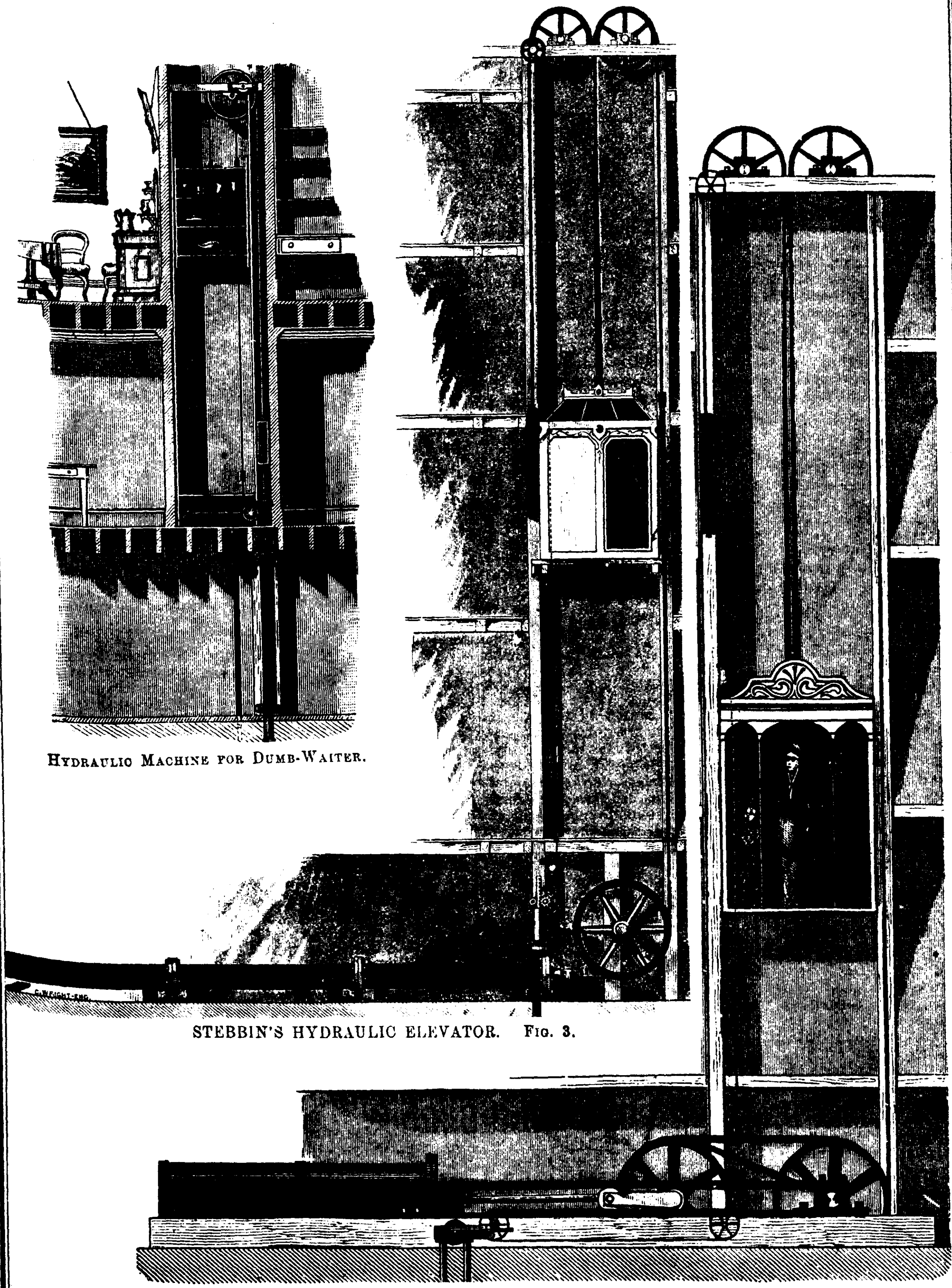


Fig. 2.

Fig. 1.

STEBBIN'S HYDRAULIC ELEVATOR.



HYDRAULIC MACHINE FOR DUMB-WAITER.

STEBBIN'S HYDRAULIC ELEVATOR. FIG. 3.

BEVINS & CO.'S HYDRAULIC ELEVATOR.

there was consumed in driving the engine about what would be consumed by four five-foot burners—say a quantity of gas that would give light equivalent to that which would be emitted from 80 to 100 sperm candles; but this quantity of gas, after being first turned into power, the power being next turned into electricity, and the electricity being turned into light, emitted light equal to that of about a thousand candles. The gas, by these transformations, was made to yield an electric light about 10 times its own light-giving power.

LIFE ON MARS.—According to the *Iron Age*, Prof. Lockyer is of the opinion that human life on the planet Mars may be very much like life on the earth ; the light cannot be so bright, but the organs of sight may be so much more susceptible as to make the vision quite as good ; the heat is probably less, as the polar snows certainly extend further, but by no means less in proportion to the lessened power of the solar rays. He agrees with others, that several very remarkable seas, including inland seas, some of them connected and some not connected by straits with still larger seas, are now definable in the southern hemisphere, in which, as is the case also with the earth, water seems to be much more widely spread than in the northern hemisphere. There is, for example, a southern sea exceedingly like the Baltic in shape ; and there is another and still more remarkable sea, now defined by the observations of many astronomers, one near the equator, a long straggling arm, twisting, almost in the shape of an S laid on its back, from east to west, at least a thousand miles in length and a hundred in breadth.

LEAD AS IODATE.—We learn from the *Polytechnic Review* that Mr. C. A. Cameron, in a paper which he has read before the Society of Analysts at Dublin, states that as a result of experiments, he has found plumbic iodate absolutely insoluble practically. Iodate acid and alkaline iodates precipitate lead far more perfectly than sulphuric acid, even when alcohol is added to the latter. The plumbic iodate formed is weighed, or, if a volumetrical inertia be desired, the following is the process: Precipitate with standard solution of soluble iodate, and filter off the plumbic iodate. The filtrate and washings are to be mixed, and the excess of iodic acid contained in them estimated volumetrically by the hydrochloric acid and hyposulphate method. As it is almost impossible to procure pure iodic acid or potassium iodate, the solution of iodate must be standardized by means of a solution of pure nitrate of lead. Owing to the slight solubility of plumbic iodate in alkaline chlorides, iodides, and bromides, none of these salts must be present. HCl rapidly dissolves iodate and lead.

ELIMINATION OF PHOSPHORUS FROM MOLTEN IRON.—A process for eliminating phosphorus from molten iron and steel by the aid of chloride of calcium or other haloid salts of the alkaline earths, has been recently patented by Messrs. H. Schulze-Berge and J. Barnstorf of Oberhausen. Based upon the fact, observed and utilized analytically by Dr. Schönn and Prof. Fresenius, that phosphorus may be separated from its compounds by calcium or magnesium at a red heat, they propose to use the chlorides of these metals, carefully excluding air or any other oxidizing agents, in order to avoid the oxidation of phosphuret of calcium and the subsequent reduction by the iron. They have constructed a special apparatus for carrying out the process, which it is claimed leaves the carbon in the iron unchanged, while silicon and phosphorus are removed.

GEOLOGICAL.—The *Polytechnic Review* learns through a private letter from Dr. T. Sterry Hunt, that the Geological Congress at Paris was a great success. There were 260 members present ; and various committees were formed, the work of which will prove highly important and useful. Arrangements were made for a Congress, to be held in 1881, at Bologna. From another source we learn that Dr. Hunt has returned from England, and will spend the winter in Montreal, Canada, where, as scientific men will be interested to hear, he expects to devote himself to important scientific investigations. Before leaving England, he accepted an invitation to deliver two lectures at Cambridge—a graceful and merited recognition of the ability and reputation of an American *savant*.

M. TREUVELOT, a foreign scientific observer, has been experimenting with butterflies, in order to solve the disputed question as to the use of the antennæ. He found they could fly when deprived of the antennæ, but with some hesitation of movement. When blinded they did not perceive sugar by the antennæ ; but if the stump were touched with it the proboscis was at once unrolled and searched for it. M. Treuvelot concludes that the sense located in the antennæ is not merely that of touch, hearing, or taste, nor a combination of all three, but one that differs essentially from any experience by human beings ; it is a kind of feeling and smelling at a great distance.

SOLAR AND ARTIFICIAL HEAT.—Prof. S. P. Langely, Director of the Alleghany Observatory, in addition to the routine work connected with the institution over which he presides, has lately been busily engaged in completing a direct experimental comparison between the heat of the sun and the highest heat attainable in the arts. The result of his investigations indicate that the sun's *intrinsic* heat is almost beyond comparison greater than that of any blast furnace, and far larger than has been reckoned by the French physicists.

Mechanics.

IMPROVED HYDRAULIC ELEVATORS.

(See pages 44 & 45.)

We have devoted considerable space to this important part of architectural construction. Elevators have become one of the greatest of modern conveniences, and have enhanced the value of property by the facilities they afford for reaching, with ease and comfort, the upper stories of public buildings, stores and hotels.

The desirability of hydraulic elevators has been proved by the increasing demand for them, both for old and new buildings. At present no public building, warehouse, or hotel is considered complete without one. By their use upper floors command as much rent as the lower ones, and are preferred by business men on account of the retirement, fresh air, and light, whereas in buildings without elevators, the upper floors remain vacant, no matter at how low a rent they may be offered. Many private houses have already adopted them, but the space taken from each floor by the cutting of the well-holes for the car, is a great drawback. All first-class houses built hereafter will be provided with such openings.

Where water can be obtained from the city mains, the cost of operating an elevator is trifling. An elevator suitable for a private house, carrying four persons, would cost about one cent for every four-story trip, and less for shorter distances. This is estimated at Brooklyn (N.Y.) prices, which are as high as any in the country—two cents per hundred gallons. Many cities charge only half this amount.

In hotels and public buildings where steam is used, the extra cost of pumping the water into a tank in the attic would not be more than a quarter of a cent per hundred gallons.

The great demand for hydraulic elevators has brought forward many machines designed to meet the existing want, some of various degrees of excellence, but many, though apparently answering the purpose, defective in strength, construction, and safety appliances. The elevators which combine the most perfect safety, strength, durability, and economy, as to space required, first cost, and the use of water, are those manufactured at the Burdon Iron Works, Brooklyn, N.Y., combining the recent improvements of a number of prominent elevator builders. The machines are put in the lowest part of the building ; in some cases entirely below the floor. Having patent self-lubricating pistons, they are nearly frictionless. They are perfectly balanced, and only use what water is necessary to raise the load and overcome the friction. The circumstances under which elevators have to work in different places are so diverse, that it is necessary to build machines adapted for various localities.

Those represented on this and the two following pages are the Stebbins elevators, with some improvements patented by Bevins, Baldwin, and Burdon.

The elevator (Fig. 1) is one of the simplest made, consisting of lengths of pipe equal to the height the car has to rise. There are four flexible piston-rods, which run over a six-foot drum at the bottom, and meet four wire ropes attached to the car, all of which are securely fastened. The four steel wire rods are capable of sustaining a weight of 30,000 pounds, and the wire ropes about the same, while the strength required in a passenger hydraulic elevator, when properly balanced, is only from 600 to 2,000 pounds.

This elevator, in its original form, has been in use for a number of years, but late improvements have placed it in the foremost rank among hydraulic elevators. Its great advantages are its simplicity, strength, safety, and economy in the use of water.

The piston is as near frictionless as possible, and having an automatic lubricating attachment, the packing will last a long time, and is easily replaced. The machine is easily put up, easily operated, and gets the full weight of water direct on the piston. The pipes can be put in the lowest part of the building, or, if that room cannot be spared, they can be put below the floor or bedded in the concrete, entirely out of the way. Where length of room cannot be had, the pipes can be made half the length, and a travelling shieve used behind the car, as shown in Figs. 1 and 2.

The safety arrangement of this machine is of the most approved construction, and has stood the severest tests. Yet it is well known by experts that putting two or three tons on a car and cutting the rope above the car is only a partial test. When the rope breaks between the car and the upper shieve, the spring is relieved and the descent of the car is checked immediately; but when the rope breaks on the other side, between the upper shieve and the piston, or the piston-rod itself breaks, experience has shown that the friction caused by the rapid descent of the car often keeps the rope so taut that the springs cannot act until the car has reached the bottom of the building. Unhappily, many serious accidents have happened which illustrate this fact.

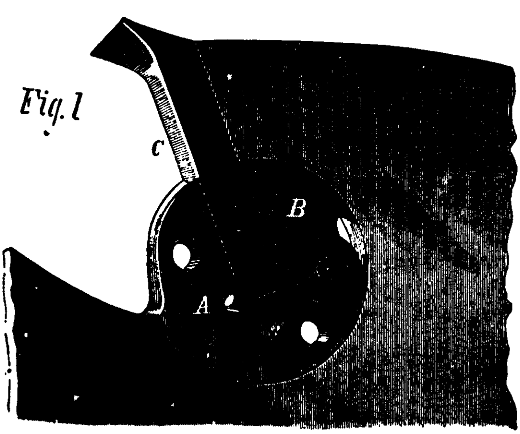
By the attachment of the Bevins improvement this difficulty is entirely overcome, making the elevator absolutely safe; and none are safe without it or its equivalent. The improvement consists in attaching an extra safety arrangement, which is operated by a travelling hammer. When the speed is increased the least particle beyond what it should be, the hammer knocks the prop from under the brake, and the car is stopped immediately.

Many hydraulic elevators in use, especially those having travelling shieves, with balance weights attached, have no protection whatever against the breaking of the cross-head or piston-rod. The Burdon Iron Works propose to attach the Bevins improvement to all such elevators, at a reasonable price.—*Manufacturer and Builder.*

SCHLEY'S IMPROVED SAW TOOTH.

Our engraving represents a novel inserted saw tooth recently patented by Mr. Frederick Schley, of 88 Cannon street, New York city. It consists of a circular holder made in two parts, hinged together, grooved around its edge, and fitted to a circular notch at the base of the saw tooth, the saw plate having a V shaped edge which fits the periphery of the holder. A space is left between the hinged portions, A B, of the holder, to receive

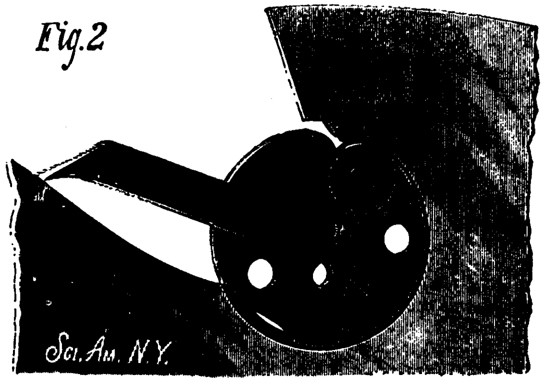
Fig. 1



the tooth, C, and there is a notch for receiving the small projection at the base of the tooth. This prevents the tooth from drawing out, and it is prevented from lateral motion by a groove in the tooth and a V shaped edge on the holder and saw plate. The tooth is inserted in the holder when it is in the position shown in Fig. 2. It is then raised up into the position shown in Fig. 1.

The tooth is in this manner clamped very tightly, and cannot become accidentally loosened except by a fracture of some of its parts. It will be noticed that the holder (which is shown full size in the engraving) takes up only 1¼ inch of the saw plate, and the entire depth of the tooth is not over 1¾ inch. This is an important saving when the recutting of the saw is considered.

Fig. 2



We recently gave illustrations of forms of inserted saw-teeth, and anything new in construction in one of the most important tools used in a great lumber country will be interesting.

THE MANUFACTURE OF STEEL.

Despite the stagnation in the iron and associated branches of trade, more than ordinary attention is now being devoted to the production of steel by different processes, and for a variety of purposes for which iron was formerly used. Special qualities are now being made in the open-hearth, by the Bessemer process, and also by the system of Dr. Siemens, by which iron and steel are made direct from the ore. The latter process is a very simple one, and has been successfully carried out at Towcester, in Northamptonshire, although the ore found in that locality is of a rather inferior character. The comparative ease with which the iron and steel is made by Dr. Siemens is not unlikely to cause much less of the latter to be made by the more elaborate processes, for he tells us that by mixing iron'ore in powder with about 25lbs. of its weight of powdered coal, and in exposing the mixture for some hours to the heat of a common stove or of a smith's fire, metallic iron is formed which, on being heated to the welding point on the smith's hearth, may be formed into a horse-shoe of excellent quality. But the iron or steel can be produced in two ways—one by way of stationary, and the other by means of a rotative furnace chamber, the latter being applicable for the smelting of poor ores. Steel plates for boilers and ships are now becoming in greater request than ever, and the result of experiments have shown that Bessemer steel, and that made by the Siemens process, in endurance and durability are far beyond the strength of ordinary wrought-iron. In resisting a mechanical force it was found that a plate of steel of 6-16ths of an inch in thickness had a far greater resisting power than an iron one 7-16ths of an inch thick. Plates, it may be said, are now being made for the Admiralty, but there is no doubt but that improvements will yet be made in them, whilst steel is now being made more uniform than it ever has been, so that grades adapted to all special purposes can be produced. Formerly this was not the case, but now something more like perfection is being arrived at by more complete analysis, and by keeping a complete record of the component parts, at least of carbon, manganese, phosphorus, silicon, and any element which contains a tenth of 1 per cent. By such a system there is a complete recipe given to the steelmaker by which uniformity is attained, and this is what has long been required. This is necessary, seeing that whilst both rail and boiler steel are soft as compared with many structural steels, yet what would be well suited for rails would be just the reverse for boilers; hence the necessity for the principal ingredients of each grade of steel being accurately known. Lloyd's, it appears, have now fully recognised steel boilers, and have fixed a test for them. Some of the plates are taken indiscriminately, and have to show a strength of from 28 to 30 tons lengthwise of the grain per square inch, the limit of elasticity having to bear the same proportion to the breaking strength as is found in ordinary boiler-plates; a specimen of the longitudinal joint has to show a percentage of strength at least equal to 74 per cent. of the soled plates, whilst a shearing of every plate used in the construction of the furnaces, combustion chambers, and tube-plates has to be cut 1½ in. wide, heated to a low cherry red, cooled in water, and then must stand bending in a process to a curve of which the inner radius must be one-and-a-half times the thickness of the plate tested. These tests are certainly severe enough, but the steel can be made to stand even greater. Steel boilers have many advantages over those made of iron, not only in less fuel being required, but in other ways as well, so their more general adoption is only a question of time. Steel wheels and waggons are now being made both in Sheffield and Barrow, and the competition for their manufacture is becoming keen. The wheels made in Sheffield have been tested on many occasions. In one instance a wheel was thrown from an elevation of 24 feet upon a solid block of iron seven times without showing the slightest sign of fracture. After undergoing the same ordeal twice more the wheel was only slightly fractured. Another test was again gone through, even more severe. An attempt was made to break the wheel with repeated blows from a 16-lb. sledge hammer. The wheel was afterwards put in the smith's fire until it had attained a white heat, and then repeatedly struck with a sledge hammer, and was with the greatest difficulty broken, whilst an ordinary cast-iron wheel was broken with one blow of the sledge hammer. After this had been done a set of steel wheels and a corf were sent running down an incline with a fall of 6 or 8 inches to the yard, the corf being loaded with half a ton of pig-iron and butted against a quantity of pig, which was broken by the corf without injuring the wheels. The result has been that steel wheels are fast superseding those made of iron, and that before long the latter will be almost unknown. In another direction Bessemer steel is also making rapid strides. For the best qualities of cutlery cast-steel has up to a recent period been used, and specially made for different grades at prices ranging from £25 to £40 a ton. Now, however, Bessemer it has been found can be made to meet the requirements of the cutlers, and at a much less cost. It will be seen a revolution is going on in connection with iron and steel, and that the latter is now making great headway, and is the metal of the day, for it appears there is scarcely one thing which is now made of iron but what can be produced in steel, and considering its greater durability, texture, and appearance, is in the long run far cheaper. Even in the existing depression in Sheffield there is probably more steel now being produced than was ever the case before.—*Martineau & Smith's Hardware Trade Circular.*

COMPRESSION IN CASTING STEEL.—In some recent French experiments it was noticed that when a lid of cast iron was placed upon a mold after casting, the ingot produced generally showed a zone of blow-holes near the surface and on all sides, while within it the block was entirely sound. Whenever the mold was not covered the entire mass contained blow-holes. This, it was argued, was due to the pressure of the gases, and consequently experiments were made by Bouniard with more than 100 tons of steel, which proved that a pressure of 6 to 10 atmospheres acting upon the interior of the ingot would make the metal solid. The mold is covered with a lid in which there is a central casting opening. It has a pipe through which steam may be introduced. The steel is cast through the central orifice, which is closed, and then steam is admitted. A copper wire is used for packing the lid. The work must be rapidly done and the mold be previously heated. In order to make the action of the pressure affect the interior of the ingot the chilling of the surface must be prevented, which is done by heating, before casting, the fire-brick lining of the inner surface of the lid. The ingot thus cast shows a depression on its upper surface. It was found that in using steel for cannon the number of compressed ingots rejected was only one-third of the number of ordinary cast ingots. Experiments made to apply the same principle to steel castings showed that although the application was more difficult, the result was the same.

WASHING OUT BOILERS WITH HOT WATER.—A letter from John E. Martin to the *Railroad Gazette* contains the following: I notice in the discussion on boilers at the last convention of master mechanics, that Mr. Hudson recommends washing out locomotive boilers with hot water. I have used the injector for that purpose lately, and with great success. We connect the boilers to be washed out with the injector of another locomotive by means of wrought-iron piping and a flexible hose-pipe that will stand a good pressure. A nozzle of five-sixteenths of an inch is used on the hose. With such a nozzle and with a boiler pressure of about 130 pounds we throw a stream of hot water of 140° Fahr. temperature into the boiler to be washed out. A gauge on the hose-pipe showed a pressure of 110 pounds, equal to a vertical weight of nearly 250 feet. The hot water loosens the scale more effectually than cold water, and the force of the stream is all that can be desired. A stream of water can be thrown a distance of 60 feet, and could be used as a fire extinguisher.

SOAP-STONE AS A LUBRICANT.—A writer in one of the foreign technical journals expresses a decided preference for soap-stone powder, in the form of dust, as a lubricant for the axles of machines. For this purpose it is first reduced to a very fine powder, then washed to remove all gritty particles, then steeped for a short time in dilute muriatic acid, in which it is stirred until all particles of iron which it contains are dissolved. The powder is then washed in pure water again to remove all traces of acid, after which it is dried, and is the purified steatite powder for lubrication. It is not used alone, but is mixed with oils and fats, in the proportion of about 35 per cent. of the powder added to paraffin, rape, or other oil; or the powder may be mixed with any of the soapy compounds employed in the lubrication of heavy machinery.

LOSS OF IRON BY RUSTING.—Interesting observations have been made recently on the Cologne-Minden road, Prussia, on the rusting of iron rails. A pile of rails of odd lengths were laid on sleepers over a bed of gravel early in 1870, and remained undisturbed until the fall of 1877, there being no use for them. It was then found that they were covered with a layer of rust 12-100 inch thick, which had to be removed by striking the rail with a hammer. The cleaned rail weighed only 398 2-10 pounds, while its original weight was 419 1-10 pounds, showing that five per cent. of the rail had been destroyed by rust, which covered the rail quite uniformly. This confirms the observation often made, that rails stacked away are much more liable to rust than those laid down in a track.

LINING FOR BOILERS.—Mr. Franz Buettgenback gives the following recipe for the preparation of a coating for the inner surface of boilers to prevent the formation of scale. We quote from the *Manufacturer and Builder*: Gradually dissolve 5 pounds of a mixture of 25 parts of colophonium, 2½ parts of graphite, and 2½ parts of lampblack, in 40 pounds of boiling gas tar, adding about one pound of tallow. The solution is diluted with about 50 per cent. of the petroleum and applied in a warm state. It has a pungent smell and should be put on rapidly, the precaution of using closed lanterns being necessary. Its effect is to cause the scale to come off in large flakes when picked.

NICKEL.—This metal, like iron, is magnetic; sufficiently ductile to be forged and drawn into slender wire. Its point of fusion is very high, and if melted in a brasque crucible it yields a homogeneous regulus of a silvery whiteness containing carbon. The author has examined whether nickel, like iron, when carbureted, is capable of being tempered and acquires elasticity, and whether it renders steel less susceptible of oxidation. The result was decidedly negative, except that alloys of iron and steel, with large proportions of nickel, 30 per cent and upward, resist the oxidizing action of air and water.—*Boussingault.*

CAR PLANNING.—A very sensible improvement has been introduced in a car on the College Hill railroad, a suburban narrow-gauge road at Cincinnati, where the seats, which run lengthwise in order to give more room, are placed back to back, so that the passengers face outward. The windows also are made nearly continuous, instead of being separated by wide panels to interrupt the view

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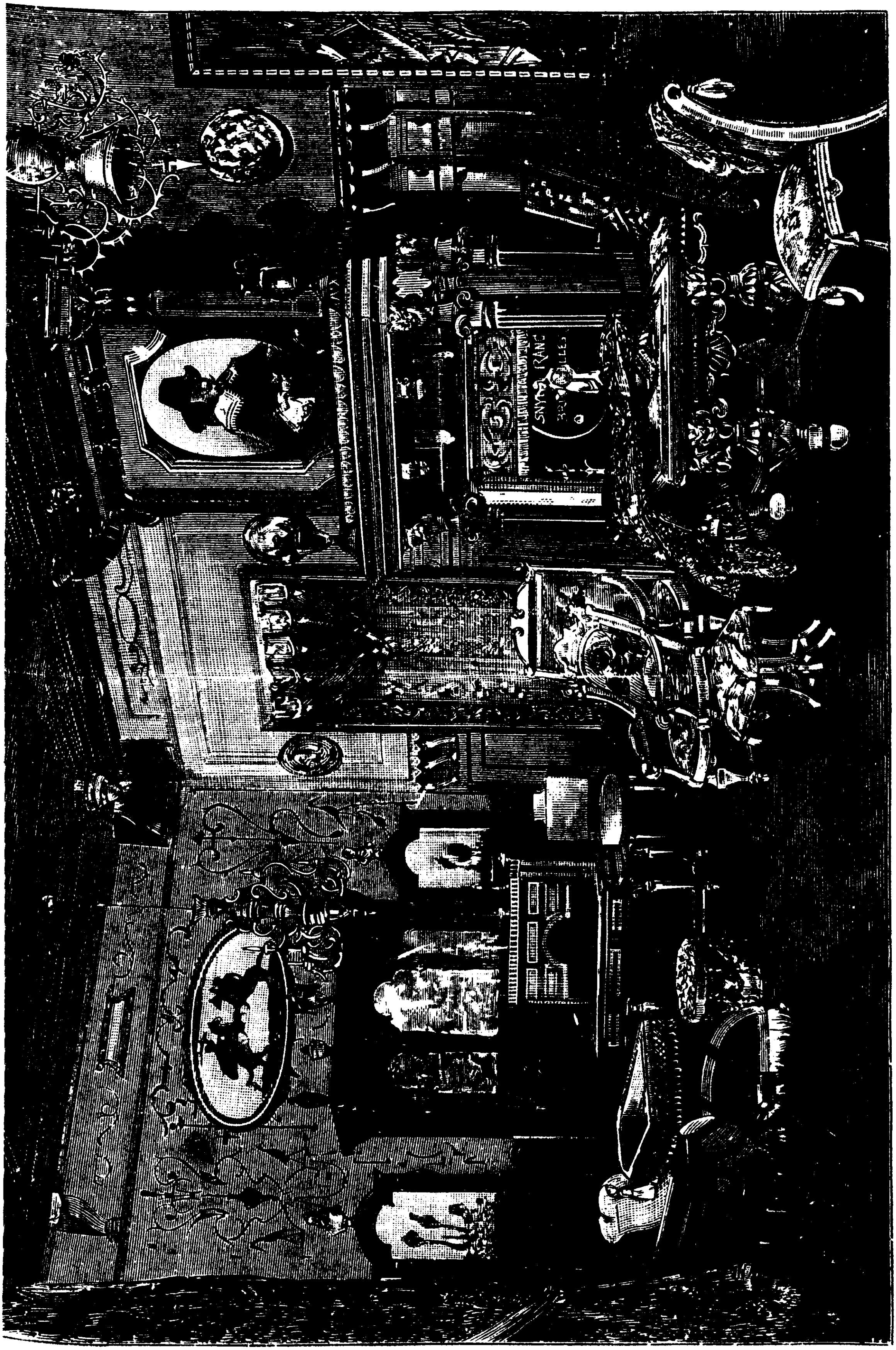
Carvers' and Gilders' Work.

GILDERS' TOOLS.

The tools used by the gilder are few, and not very costly. A short description of each may be acceptable.

The *gilder's cushion* is used to spread the gold on, ready to cut up for use. It is a piece of wood about 8 inches by 5, covered with calves' skin, with a piece of soft fabric introduced between the wood and the leather. The leather is strained tightly over the board, and nailed on to the edge. A piece of parchment about three or four inches broad is nailed half way round the board, and is meant to keep the gold leaf from flying off, as the least disturbance of the atmosphere is enough to send the gold leaf flying. A loop is placed under the cushion in which the thumb is inserted, and serves to carry the cushion. See Fig. 1.

The *gilder's knife* is a light flexible blade, with a smooth edge, but not very sharp, used to cut the gold on the cushion to the required shape. It must be kept clean, smooth on the edge, and bright, or it will tear instead of cut the gold. See Fig. 2.



BELGIAN FURNITURE AT THE EXHIBITION.

The *gilder's "tip"* is a thin layer of flexible hair held together between two pieces of cardboard, and made of various widths, and the length of hair varies also. The tip is used to convey the gold from the cushion to the work required to be gilded. The manner of using the cushion, the knife, and the tip, is as follows:—The gilder first proceeds to open the book of gold leaf, and dexterously blows the leaf from the book into the cushion till he has about a dozen ready for use. He then takes up the cushion, and slips his left hand thumb through the loop underneath; then with the end of the knife he carefully takes up a leaf of gold, and dexterously brings the metal to the front of the cushion, when with a slight puff of wind from his mouth on to the centre of the leaf, it is made to lie perfectly flat. He then with the knife cuts it to the required shape, and places the knife between the fingers of the hand carrying the cushion. The tip (which is also carried between the fingers of the left hand) with the right hand is then drawn quickly across the hair, which gives it a little moisture, and on being placed on the gold required to be lifted, carries it to the work to be gilded. This operation is repeated till the work is complete. See Fig. 3.

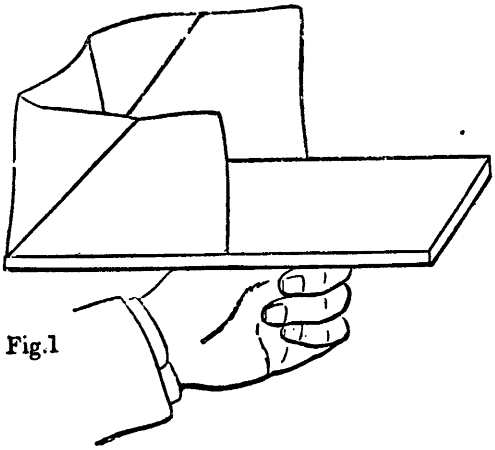


Fig.1

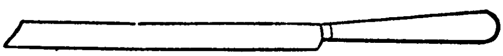


Fig.2

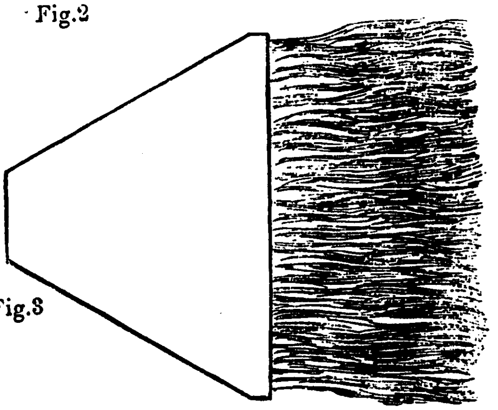


Fig.3

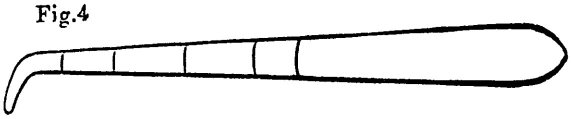


Fig.4

The *burnisher* is a tool used by the gilder, and is made of either agate or flint. For beads and hollows, the burnishers are of different form and size to suit the work, and are usually curved near the end. The method of using the burnisher can only be attained by practice, when the sound and smooth passage of the burnisher over the gold will tell the workman if he has been successful in obtaining a good burnish. See Fig. 4.

Brushes of various descriptions are in constant use by the gilder: ground-hog's hair flat and round; these are used for the various preparations of gold size; skewing brushes in quill are used for skewing in the gold after it has adhered to the oil gold size; gilder's mops in quill are used to dab the gold to make it closely adhere to the size; badger and camel's hair brushes of all sizes are useful, as well as sable and other tools.

Modelers, both steel and wood, are used to fashion ornaments that are broken and lost.

The gilder also uses pumice stones of various shapes, glass paper, pallet knives, &c.—*The Practical Carver's and Gilder's Guide.*

PREPARATIONS USED IN GILDING.

We shall now describe the various preparations used by the gilder, and will again mention the importance of having clean pots and brushes, and of being particular to keep all preparations from dust and dirt. This is necessary if the amateur or tyro wishes to accomplish beautiful and brilliant work. We shall be anxious to give a full description of how the work is to be performed, and will give the best practical receipts known to the trade, and in so doing the experience of nearly half a century will aid us in the task. The first preparation we shall mention is—

Parchment Size.—The size used by gilders in England is made from parchment cuttings, or cuttings from gloves. In America there is a white glue in use, which is not so fine or suitable for the work. Parchment size is made by first washing as many cuttings as you have room for in a clean stone pipkin; cover them with water, and let them simmer for two hours, when, to test if it is strong enough, the inside of the palm of the hand should be slightly wetted with the size, and the other hand pressed closely several times upon it, when if it be found to be *sticky*, the size may be poured off into a clean basin to cool for use. This size is most important to the gilder, as he uses it to mix nearly all his preparations in the practice of his art. When it is cool it is like a jelly, and the stronger the size the firmer it will be. The bottom and top of the basin of size will be found not so pure or transparent as the middle, and the gilder is always particular to mix his *burnish* and *matt* with the finest and clearest size, while the tops and bottoms go to mix whitening, stopping, thick white, &c. There are two or three qualities of parchment, and only the cuttings of fine parchment will make the best size. If the size is too thick, it will be necessary to add water in making up some of the preparations.

Hitherto experience has decided the strength of burnish gold size, so that when the burnisher is applied it will not friz up; and even the man of experience is somewhat puzzled when he wishes to get on with his work, and has hot size to make up his preparations.

A few little experiments have been tried for the benefit of the tyro, with a view to determine, as near as can be, the strength required for a good burnish, without leaving it to an uncertainty.

There is a little instrument used to test milk called a *Lactometer*, and is a *float* which records the density of the milk. The tube is marked "M., 1, 2, 3, W.," and if the milk is pure the float will register M. on the surface of the liquid, and 1 if a quarter water is added, 2 if one-half, 3 if three-quarters, and W. if pure water.

By this little instrument the density and strength of size may be known exactly, without leaving any doubt on the matter; and as a standard to regulate the strength required, a good burnish will be the result of size where the float registers a little higher than 1. Matt should be stronger, and the float would register nearer the 2.

If the size is wanted weaker, the float will sink nearer to the W.; if stronger, nearer the M.

This instrument and deep glass to put in the milk or size may be had of chemists for about two shillings and sixpence.

Oil Gold Size.—This size is a mixture of boiled linseed oil and ochre, well ground up together. The carver and gilder seldom, if ever, makes this size for use, as it can be purchased cheaply by weight. It is too solid for use as kept in stock, and is thinned down with boiled linseed and fat oil to about the consistency of cream.

Matt Gold Size.—This also is purchased of artists' colourmen by weight. It is of a chocolate colour, and very stiff. When it is required for use, a small portion of parchment size is put into a stone pot, when the size is melted, a small portion of the matt gold size is added, and stirred till it is dissolved; more is added till it is of the consistency of thick cream. This preparation is obliged to be used warm, as the size with which it is mixed would coagulate.

Burnish Gold Size.—Like the preceding, this is usually bought of the artists' colourmen, and is mixed like the above. It does not pay to make this article, but the following ingredients ground together very finely would bring out a good burnish :— Black lead, deer suet, and red chalk, one ounce each, with one pound of pipe clay, ground together to a stiff paste. This size is made ready for use like matt.

Clay.—This preparation is usually bought of the artists' colourmen, and is mixed the same as burnish size.

Gilder's Ormulu.—This preparation is mixed with medium parchment size, to give the oil and matt gilding a deeper and richer appearance. To medium strength parchment size add enough of the following receipt to colour it. It is better strained before putting into the size. Mix together

¼ pint of spirits of wine,
½ oz. of garnet shellac,
1 dram red Saunders' wood,
½ dram tumeric.

Stopping.—This is a mixture of size and whitening to the consistency of putty. It is used for stopping up holes, or making up defects in the work.

Thick White.—This is a mixture of whitening and parchment size to the consistency of cream, and is put on the parts to be burnished previous to the burnish size.

Gold Leaf.—It may be interesting to know a little of the properties and manufacture of gold leaf; and as the gilder will be most probably questioned by many wishing for information concerning the material he so beautifully lays on and burnishes, we give the following facts for the benefit of the intelligent workman. The gold leaf laid on by the gilder contains about 1-80th of its weight of an alloy of silver and copper, and is melted into ingots of six or eight inches in length. The ingot is passed between solid steel rollers, until it is reduced to the thickness of a ribbon. This ribbon is then cut up into small square pieces, which are hammered on an anvil until each piece becomes one inch square, and about 1-760th of an inch thick, weighing about six grains. One hundred and fifty of these small squares are then interleaved between pieces of vellum about four inches square, and a parchment envelope being folded round them, are beaten with a heavy hammer until each piece is expanded to nearly the size of the vellum. They are then taken out, and each piece is cut into four; and the six hundred pieces thus resulting are interleaved with sheets of gold beater's skin, and again beaten till they are quadrupled in size. By dividing each sheet again into four, 2,400 leaves of gold are produced, each of which is about one-fourth the size of the skins. These 2,400 are divided into three parcels of 800 each,—again interleaved with gold beater's skin,—and again beaten till they nearly reach the size of four inches square. The required degree of thickness is now attained, and the leaves are cut to about three and a quarter inches square, and laid in books of twenty-five leaves to each book. Now, by calculating the thickness of the ribbon of gold, as it passes into the hands of the gold beater, and the subsequent division which it undergoes, and allowing for waste, it is proved that the leaves are not more than 1-280,000th of an inch in thickness; and in France, where the process of beating is carried still further, the thickness is said to be not so much as 1-400,000 of an inch. An alloy of silver and copper is added to assist the gold-beater in his work, as it makes the metal more malleable. Pure gold would crack. The chests of treasure taken after the success of the British arms in the Punjaub were found to contain gold pieces, the greater part of which were cracked in the process of stamping, the metal being too pure to stand the blow.

By the weight and measure of the best wrought gold leaf it is found that one grain is made to cover 56¾ square inches; and from the specific gravity of the metal, together with this admeasurement, it follows that the leaf itself is 1-282,000th part of an inch thick. The size of the English gold leaf is 3¼ inches square, and foreign gold leaf is considerably smaller. The *deep* colour gold is preferred for gilding in general, and green gold, being much lighter, is used for special purposes.

Whitening.—The whitening used by the trade is usually bought by the cwt. in barrels, and is a very superior article to that used in the household, as there is no grit in it, and the gilder is particular to protect the whitening barrel from dust. Before being used for the various preparations, it is rolled out on a board with a rolling pin until it is perfectly smooth and fine.

Whitening up.—Nearly all the work undertaken by the gilder, especially that of picture and looking-glass frames, requires to have a foundation of whitening and size: the reason is that it can be got up very much smoother; and a brilliant burnish can only be produced on a good foundation of whitening. For outside work paint is used as a foundation, and the gilding is invariably done in oil, as no other gilding would stand the weather. It is therefore important that whitening-up various mouldings and articles should be practised by the learner. It has been previously noticed that all the stock mouldings kept by the gilder comes to hand ready whitened-up from the manufactory, and there they have a ready method of whitening-up with templets, which renders the mouldings cheaper. The gilder has oftentimes frames to make to pattern, when he has to get the moulding made, and then whiten it up.

The first thing to be done is to give the moulding a priming of *thin white*, composed of parchment size and whitening, and laid on *very hot*. After this is dry, the irregularities and defects of the moulding are filled up with *stopping*, and then *thick white* is evenly laid on with a brush. As before observed, the *thick white* is made by increasing the quantity of whitening to a given amount of size till it is about the consistency of thick cream. When several coats of *thick white* has been laid on, each one being dry before the next is applied, *pumice stone* of various shapes is applied to the beads, hollows, flats, &c., giving the work a coat of white at the same time, and well rubbing down all the rough projections in the moulding, and also taking care to square up all the angles in the various members of the moulding. In smoothing it out, superfluous whitening will be rubbed out by the pumice stone, which must be taken off. When an Oxford frame is wished to be whitened up, flat pumice stone is used, with beads on both edges, and the frame made of deal.

After repeated drawing up, it is smoothed off with clean water and pumice stone. The thickness of whitening on the wood should be 1-16th of an inch, and in some instances thicker. Care should be taken not to use the whitening and size when it is beginning to "turn off," as it then loses a great part of its adhesive quality. Different strengths must also be guarded against, as a strong coat of whitening size laid on a weak foundation will be likely to peel up when the after preparations are laid on.

Painter's Work.

KALSOMINING AND DISTEMPER.

Distemper Colours for Walls.—If distemper is to be applied to a wall or ceiling which is covered with plaster, some whiting is put into water, where it may be easily broken and diluted if allowed time to soak; it must be completely saturated, and when it has settled, the clear water must be poured off. To correct the too great whiteness, and to prevent a yellow cast, grind separately in some water a little indigo or ivory black, and mix with it; then add to the mixture some strong size which has been previously warmed, well stirring the whole till properly mixed. The whole of the distemper must be strained while warm, in order to remove all impurities and thoroughly mix the colour. When this is done, the distemper may be put into a cool place till it is formed into a weak trembling jelly, which is the only proper state in which to apply it to the walls. All size distemper colours which are applied to walls, and which are mixed with whiting, should at all times be worked cold, and of a weak, trembling jelly, otherwise it will be impossible to make good work, and great care should be taken not to have too much body in the colour, for it will certainly crack and fall off in scales, as it is not the strength of the size that causes the work to crack, but the body of color. There is a great advantage in having a sufficient quantity of size in the first coat of distemper, as it binds hard, and stops the suction of the wall, in consequence of which the next coat, if properly prepared, will not move the first coat, but it will work perfectly free, and when dry, the work will have a uniform and solid appearance. This method of whitewashing and coloring walls is far superior to lime, as it works much smoother, and when properly mixed and worked upon a new wall, it will not crack and fall off in scales; it also covers better, and after being repeatedly applied for a number of years, the walls need no scraping, as the color easily washes off with a whitewash brush, after they have been well soaked with water.

Excellent Green for Walls.—Take two pounds of mineral green, and six pounds of good green verditer; mix them together, and grind in water; mix with size, and work the color when it has formed a jelly. This green has a good body, and is very durable.

Another.—Mix a solution of common salt and blue vitriol in water; by putting copper plates therein, a green precipitate will be gradually formed, which may be mixed with whiting, and then spread on a board to dry.

Another.—Good and Cheap. The following color must not be allowed to come in contact with *iron*, as the vitriol powerfully attacks it and thereby spoils the color.

Take eight pounds of blue vitriol (sulphate of copper), and two pounds of whiting, boil them in a brass or copper kettle, in three gallons of water, one hour, stirring the mixture the whole time till thoroughly dissolved. Pour it into an earthen pan, and let it stand several days. Decant the water, and mix the sediment with size; apply it to the walls with a whitewash brush. The shade may be altered or improved by adding a little Dutch pink or chrome yellow. When required for use, it must be dissolved in water, mixed with size, &c.

Drab, in Size.—An excellent Drab.—Dissolve in water, whiting, and grind some burnt umber very fine in water. Mix it to the shade required. Strain the color as usual, and mix with size. Raw umber will make a drab of a different shade.

Another.—Dissolve separately some whiting and yellow ochre in water. Take a proportionate quantity of each, and mix them together till a bright yellow is produced. Grind a little lampblack very fine in vinegar, and with it sufficiently stain the color to form a drab; another shade may be obtained by adding a little Venetian red. Thus, by diversifying the proportions of the above-mentioned pigments, a great variety of shades may be produced.

Blue Verditer.—The best blue in use for distemper colors on walls. Dissolve some pieces of copper in aquafortis, and when dissolved, produce a precipitation of it by adding quick lime, in such doses that it will be entirely absorbed by the acid. In order that the precipitate may be pure copper without any mixture, when the liquor has been decanted, wash the precipitate, and spread it out on a place of linen cloth to drain. If a portion of this precipitate, which is green, be placed on a grinding stone, and a little quick lime in powder be added, the green color will be changed into a beautiful blue. The proportion of lime added is from seven to ten parts in a hundred. As the whole matter has already acquired the consistency of paste, it soon dries. It is cheaper to buy the verditer than it is to make it.

French Gray.—Whiting predominates in this color; it is treated as the other grays, but with this difference, that it admits of lake instead of black. Take the quantity, therefore, of whiting necessary, and soak it in water, then add the Prussian blue and lake, which has been finely ground in water. The quantity of each of those colors should, of course, be proportioned to the warmth of color required. This is a handsome and delicate color for walls. Either of the preceding grays will answer for the first coat, as the French gray will cover upon it very well. Rose pink may be substituted, but it does not make so brilliant a color, neither is it so durable.

Brilliant Peach Blossom.—Orange lead (orpiment) and whiting when properly mixed, compose a beautiful and unfading color; it is much used by paper stainers. Dissolve whiting in water; then grind very fine in water a small quantity of orange lead and mix with the whiting; add sufficient size to the mixture, and strain it through a sieve, and put it into a cool place till fit for use. This color must be worked in a jelly, as the orange lead is heavy, and would otherwise separate from the other parts and sink to the bottom in its pure state.

Salmon Color.—An excellent salmon color may be made by dissolving whiting in water, and tinging it with the best Venetian red, finely ground in water. A little Venetian red mixed with lime whitewash, and a proportionate quantity of alum, will answer very well for common purposes. It is important, when Venetian red is required, that you obtain it genuine, as a spurious article is frequently sold for it, which, when used, spoils the intended effect when applied to fine work.

Light Gray.—A small quantity of lampblack mixed with whiting composes a gray; more or less black, of course, regulates the shade. With whiting, therefore, mixed with black in varying proportions, a wide range of shades may be obtained, from the darkest to the lightest gray.

Straw Color, in Size.—Dissolve the necessary quantity of whiting in water, then grind in water some chrome yellow or Dutch pink. Mix to the shade required, and add some strong size. Strain the color through a hair sieve, and set it in a cool place till fit for use.

Buff.—A good buff may be produced by dissolving separately whiting and yellow ochre in water. A little Venetian red must be added to give the yellow a warm cast. Mix with size, and strain as before directed.

Orange Color.—For walls and stables. Use two pounds of green copperas, dissolved in hot water, just sufficient to dissolve it. Mix it well with eight gallons of fresh lime wash. Stir it well while using.

Another.—A mixture of whiting, yellow ochre, or Dutch pink and orange lead. These ingredients may be proportioned according to one's tastes. This color cannot be worked except in a size jelly, as the orange lead is a color which has great body.

Lilac.—Take a small quantity of indigo finely ground in water, and mix it with whiting till it produces a dark gray; then add to the mixture some rose pink. Well mix and strain the color, and a beautiful lilac will be the result.

Pink.—Dissolve in water separately, whiting and rose pink, mix them to the texture required; strain the color through a sieve, and mix with size.

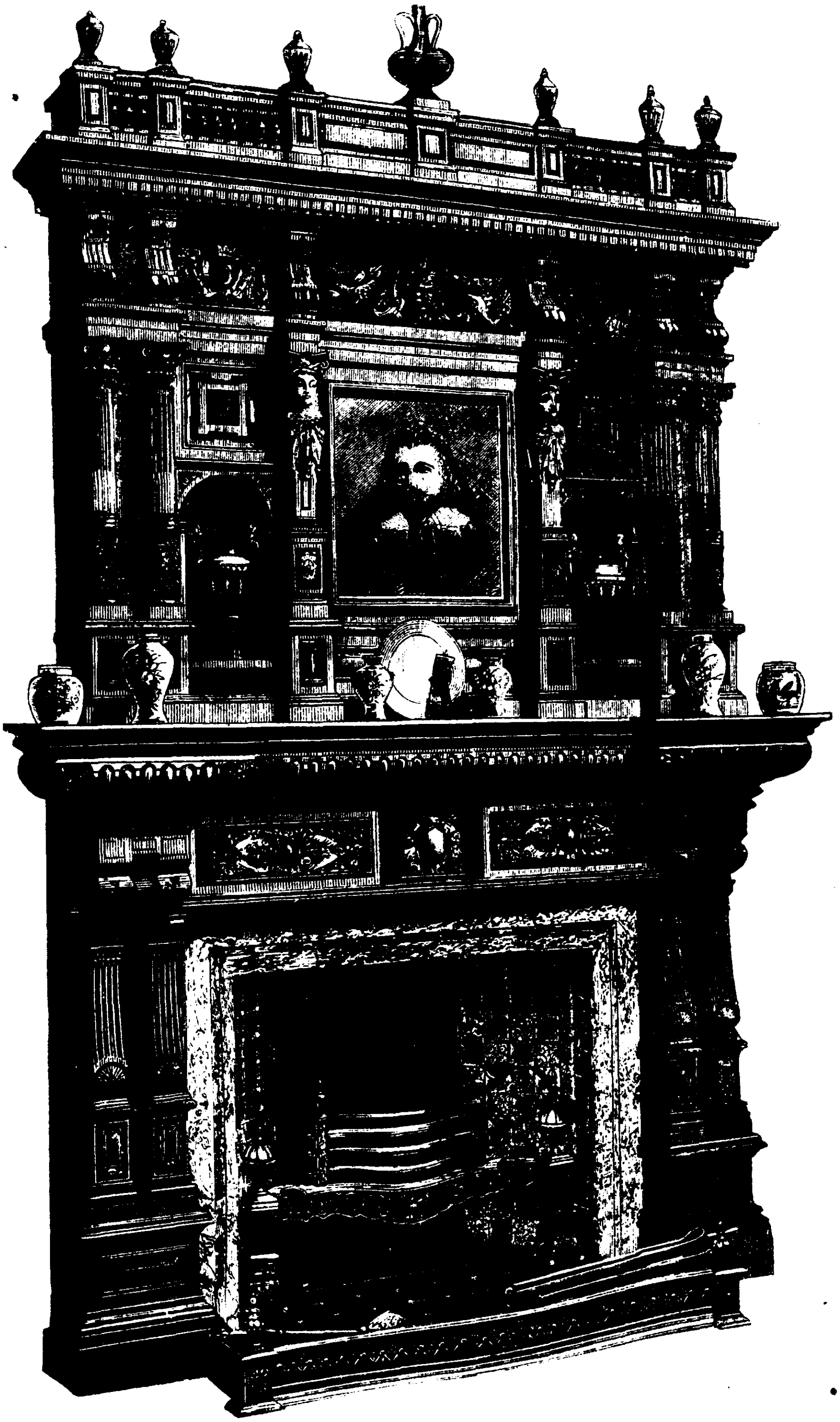
Blue in Distemper.—A good blue is made by dissolving whiting in water, and mixing some indigo with it.

Ordinary Kalsomining.—Buy the best bleached glue if the walls are to be white or some light tint (if dark, it is immaterial so the glue be clean) and use it in the proportion of a quarter of a pound to eight pounds of whiting. Soak the glue over night; in the morning pour off the water, as it simply swells while soaking. Add fresh water, put it in a pail, and set that in a kettle of boiling water. When dissolved, stir it into the whiting, adding enough water to make it, after mixing, of the same consistency as common whitewash. It may be tinted any colour, and is applied with a whitewash brush. If the colour is rubbed smooth in a little water and then mixed with the wash it will be more even. If the walls have been previously whitewashed scrape away all that will come off, and wash with a solution of vitriol—two ounces in a pail of water. The vitriol will be decomposed, forming zinc white, and plaster-of-Paris, to which the kalsomining easily adheres. It is important to dissolve the glue in a hot-water bath, for if scorched by too great heat its tenacity is impaired or destroyed. Whiting is simply chalk freed from impurities and reduced to a fine powder, and is also known under the names of Paris and Spanish White, though the latter is really a white earth found in Spain. There is a great difference in whitewash brushes, and the beauty of the work, as well as the ease of performing it, depends very much on a good brush, making it well worth while to pay the difference between that and a cheap one. For the inexperienced it is more difficult to lay on tints evenly than pure white.

Lime Whitewash.—Lime whitewash is made from lime well slacked. Dissolve two pounds and a half of alum in boiling water, and add it to every pailful of whitewash. Lime whitewash should be used very thin, and when it is sufficiently bound on the wall by means of alum, two thin coats will cover the work better; this may be used for the first coat, thinned with water. Most whitewashers apply their wash too thick, and do not mix a proportionate quantity of alum to bind it, consequently the operation of the brush rubs off the first coat in various parts and leaves an uneven surface, and the original smooth surface of the wall is entirely destroyed.

For Out-door Work.—Eight ounces of lime newly slacked, by dipping it in water, and allowing it to break down in the open air. Now take two ounces of Burgundy pitch, and dissolve by a gentle heat in six ounces of poppy or linseed oil; then add to the hot lime two quarts of skimmed milk while in a hot state. Add the mixture of pitch and oil a little at a time, stirring all the while. Lastly, add three pounds of powdered whiting.

We have pleasure in calling the attention of patentees to the card of Mr. Henry Halloran, Patent Solicitor, Sydney, New South Wales,—late Principal Under-Secretary of that colony. Inventors and patentees will find it much to their advantage to place themselves in communication with that gentleman, whose name stands high, as one who has had much experience with public business, and whose late official position has given him a very extended and influential circle of acquaintances.



CHIMNEY-PIECE EXHIBITED AT THE PARIS INTERNATIONAL EXHIBITION.

The above engraving, taken from the "*Art Journal*," represents a mantel exhibited by Messrs. JOHNSTON, JEANES & Co., of London, England. The design is of a pure and graceful character. It would be difficult to overpraise productions of this kind, and the study of them cannot fail to gratify many of cultivated taste, and to be most acceptable to those who are less educated in Art. Carvers and designers may take lessons from the above cut of much benefit to them hereafter.

Horology and Goldsmith's Works.

FORMULAS AND PROCESSES.

To Melt Gold Alloys for Jewelers' Use.—Make a good fire, either in forge or furnace. Heat the ingot in which you wish to cast the gold a little hotter than boiling water ; now put the alloy in the Hessian crucible, and after adding a small amount of pulverized borax, put in and leave in the fire until melted. Cast this in any ingot which is clean, and after breaking the bar in pieces small enough to put in the pot again, remelt the gold, do not add any borax this time, but when the gold looks clear and smooth on the top, add (for six ozs. gold) a piece of saltpetre about the size of a pea, and in about half a minute pour the gold. Be sure and keep up the heat after adding the saltpetre—then pour a few drops of oil into the iron ingot ; shake it out, and pour the gold. If the gold, silver and copper were clean when you commenced, the gold will roll well. Much depends on the first rolling of the stock ; 18 k. should be subjected to a very heavy strain, the first and second draughts. This gives a grain to the stock ; light draughts stretch the gold on the surface and the middle portion remaining as cast, causes the gold to crack. Many good bars have been condemned when the difficulty was in the rolling. After the 18 k. has been rolled to about twice its length, it must be annealed, then rolled to the size you need. When you melt 14 k, proceed as with 18 k. Give it as heavy strains in the mills, but do not roll as much before annealing as the 18 k.

The other carats of lower grade do not require the use of saltpetre to toughen, instead of which use a small amount of sal ammoniac ; proceed then as in the other carats.

When you anneal red gold, do not quench when red hot, as it will cause it to slit or seam ; allow the gold to blacken before quenching,

Always melt new alloys twice, and do the same with solders, as the copper may not be thoroughly mixed the first melting ; and if it is not, it will show it in streaks in the gold, and the solder will not flow.

To Melt from One to Thirty Dwts. of any K. Gold without the Use of a Forge.—Prepare a piece of charcoal about a foot long and two or three inches wide ; anneal it in order to remove the air from it, and prevent it snapping ; flatten one side by grinding on some flat surface. Dig a hole deep enough near one end, to hold the quantity you wish to melt. Now cut a strip of sheet iron, about an eighth of an inch wide and long enough to bend an ingot. Say you want to cast a bar one inch wide. Bend the strip this shape ⊂. Take a piece of sheet iron and cover the ingot ; place both of them on the charcoal, the opening near the hole in the coal. Bind tightly with iron binding wire all together. Put the gold in the hole of coal, and fuse with the blow-pipe. Then incline the coal, which you hold in your left hand, the gold will pass in the ingot. This gold will be tough. By bending a number of ingots and keeping them on hand, you will save much time. They can be used a number of times.

Dry Colored Gold Alloy.—In all these recipes, unless otherwise expressed, the constituents named will always mean fine gold, fine silver, and refined copper, unless the contrary is stated.

No. 1. 17 k.—Gold 15 dwts.; silver 1 dwt., 10 grs.; copper 4 dwts., 17 grs.

No. 2. 18 k.— Gold 1 oz.; silver 4 dwts., 10 grs.; copper 2 dwts., 5 grs.

No. 3. 18 k.—Gold 15 dwts.; silver 2 dwts., 4 grs.; copper 2 dwts., 19 grs.

No. 4. 18 k.—Gold 18 dwts.; silver 2 dwts., 18 grs.; copper 3 dwts., 18 grs.

No. 5. 18 k.—Gold 1 oz., 1 dwt., 6 grs.; silver 3 dwt., 10 grs.; copper 4 dwts., 12 grs.

No. 6. 19 k.—Gold 1 oz.; silver 2 dwts., 6 grs.; copper 3 dwts., 12 grs.

No. 7. 20 k.— Gold 1 oz.; silver 2 dwts.; copper 2 dwts., 4 grs.

No. 8. 22 k.—Gold 18 dwts.; silver 12 grs.; copper 1 dwt., 3 grs.

Or, take English sovereigns, which are 22 k. fine, but they have too little copper to wear well.

Solder for above Alloys.—In making gold solder for the foregoing alloys, take of the alloyed gold which you are using 1 dwt.; silver 6 grs. Or, Gold, alloyed as before, 1 dwt.; silver 5 grs.; copper 1 gr. *(To be continued.)*

Horse Shoeing and Smith's Work.

INSTRUCTION FOR FITTING AND DRIVING THE SHOE.

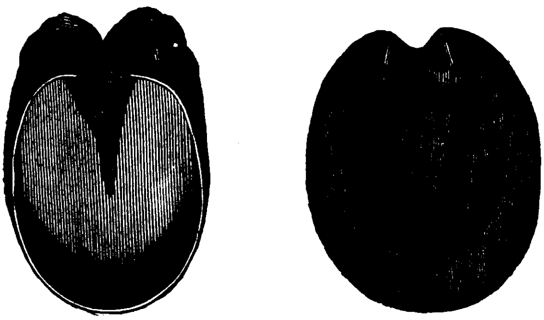
The first thing to be done is to carefully examine the horse's feet all around, to see that they are of a natural shape, taking care to abstain from any action that will tend to excite the horse.

The shoes should be removed one at a time, and the nails carefully drawn after the clinches are cut one at a time ; anything like tearing off the shoe by main force should by all means be avoided.

The shoe being removed, the rasp should then be used on the edge of the foot where the shoe has been, removing all dirt and gravel which may have accumulated there, and thus prevent injury to the shoeing knife.

If the foot is healthy and of a natural shape, and has been shod regularly, no alteration is required, but simply to pare out the sole of the foot, removing the bors entirely, and opening out the heels back. The surface of the frog should be trimmed off very little, but the sides should never be cut.

No. 12.



By reference to Plate No. 12 the exact idea of the system of paring the foot may be gained. It has been practiced successfully, and is recommended for the simple reason that by the system of removing the bors and opening out the heels, contraction is prevented, and the frog retains its natural shape, because all pressure is removed from each side.

The foot should not be scooped out so as to leave the wall projecting without any support ; for the wall of the hoof is the base upon which the horse travels, and this should be supported by a sufficiency of the sole as a "ground surface." The shoes should be removed and the feet prepared one at a time.

In fitting a shoe to the foot, after it has been thoroughly prepared, the farrier should take hold of the foot and see that the shoe is perfectly easy on the heels, and that he has sufficient room all around in the manner illustrated on Plate No. 11. If the shoe is found to fit well everywhere, he will take the foot between his knees, and placing the shoe properly, drive the nails with great care, so that the shoe cannot get out of its proper place. When the nails are started he should hammer them home lightly, or according to the foot he is working on. The three nails on the inside and outside, toward the toe, should always be driven a little tighter than the heel nails, so as to prevent pressure on the heels. No man should be in a hurry in shoeing a horse, but should always be careful in fitting and driving the shoe as instructed.

A shoe should never be fitted tightly, unless the coffin-bone has too much play ; then it should be fitted tight around the toe and each quarter, as far as the nail-holes extend back, in order to contract the foot, and bring the coffin-bone to its proper place. Such cases are, however, very rare.

The heels of the shoe should never be allowed to curve inward toward the frog, and the foot should be prepared so as to prevent any pressure from the shoe on the heel, in the manner shown by Plate No. 14, at the same time allowing the bearing of the shoe to be perfectly equal.

If the horse has a long foot it should be shortened on the toe as much as possible—the more the better—for the hoof grows out more quickly at the toe ; and it is necessary, because in a case of this kind the coffin-bone is necessarily out of its proper position, and the operation of shortening the toe must be continued until it resumes its natural shape ; but a close operation, and working the horse at the same time, is not recommended, because the foot can be brought to its proper shape by cutting gradually in time.

After the cutting has been performed, a shoe should be fitted

No. 14.

so as to have the pressure on each quarter, and with heels, if the horse's heels are naturally low, in order to prevent a sudden change.

A horse should be re-shod at least once a month.

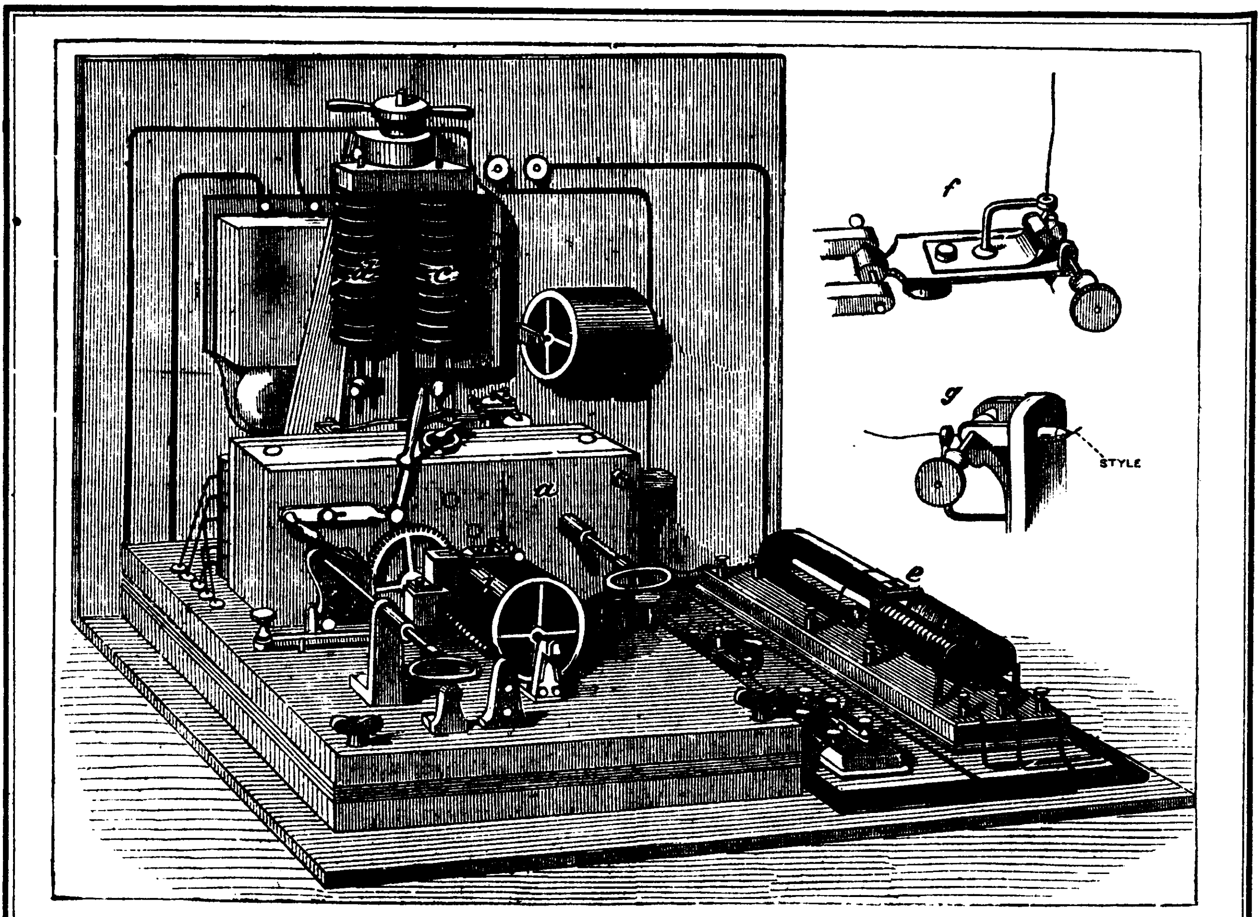
Telegraphy & Electricity.

AUTOGRAPHIC TELEGRAPHY.

Autographic telegraphy, or the process of transmitting messages in the actual handwriting of the sender, has occasionally during the past thirty years constituted the special study of scientific minds. So long since as 1850, Mr. F. C. Bakewell invented a copying telegraph by means of which autographic telegraphy was accomplished. In this instance the message was written by the sender with a gummy ink or varnish on metallic paper or tinfoil, and this paper was by the aid of mechanism used to actuate electric currents in such a way as to produce a record at the distant station by the chemical decomposition of a solution with which the receiving paper was damped. Both the written message and the paper were fixed around cylinders of similar form and dimensions, on being placed in the transmitting and the other in the recording instrument, and the cylinders were caused to revolve with corresponding velocities. Each time the gummy and consequently raised lines of the writing were crossed by a pointer under which the metallic paper was traversed in the transmitter, a mark corresponding in position was made on the prepared paper at the receiving end. It therefore followed that the sum of all the marks reproduced the writing itself. Mr. Bakewell successfully reproduced the writing in white on a blue ground, but the process failed to become one of public utility owing to the extreme slowness with which the apparatus worked and the difficulty that was experienced in maintaining uniform and synchronous motion in the instruments. In 1856 the Abbé Castelli, in Italy, endeavoured to solve the problem of autographic telegraphy in a similar manner. His apparatus was exhibited in England, and it was used practically between Paris and Marseilles and Paris and Lyons. Plans, drawings and autograph sketches were faithfully reproduced at distant places, but it was found that the apparatus had not only the defects of Bakewell's, but it was very costly and complicated. Two other subsequent workers in this direction were M. Meyer and M. Lenoir, who tried to accomplish the same results with ordinary ink. They, however, pursued their investigations quite independently of and unknown to each other. We have recently been afforded the opportunity of examining the latest example of this class of apparatus at the General Post Office, where it has been submitted to the authorities for trial. This is the invention of M. d'Arlincourt, of Paris, and its general principles are similar to those which govern Bakewell's system. The distinguishing feature in d'Arlincourt's apparatus, however, is the introduction of an extremely ingenious synchronous movement, by means of which the speed of travel of the cylinders is rendered uniform, both in the transmitting and the recording machine. The message to be sent, which may be either in the ordinary hand or shorthand, is written with a thick gummy ink upon a strip of metallic-faced paper about 12 inches long and 1½ inches deep, which is wrapped around the cylinder of the transmitting instrument. A strip of white paper chemically prepared and of similar dimensions is placed on the cylinder of the recording apparatus, and the instruments are placed in electrical connection and started. The raised writing, actuating the electric current, causes a reproduction of the original message in facsimile on the paper in the recording instrument, which may be hundreds of miles away from the other. Upon the occasion of our visit the two instruments, although in the same room, were practically placed 200 miles apart. The writing can be reproduced in either blue, brown, red, or black, according to the chemical preparation of the paper, but always on a white ground, and a number of copies can be taken from the original. In the same way, sketches, plans or drawings may be faithfully transmitted: some sketches were, in fact, accurately reproduced on the occasion of our visit. Although the apparatus is perfect in its action, it still has one drawback, which was common to its predecessors—that of slowness of reproduction. The time occupied in revolving the cylinder a sufficient number of times to allow the pointer to traverse the whole surface of the paper is seven minutes, and this rate of speed is far below that required and attained in practice for commercial purposes. The Post Office authorities, to whom we are indebted for our inspection, do not, therefore, see their way to utilise M. d'Arlincourt's ingenious invention at present. It is, however, being worked in France in fortresses and for similar military purposes, for which, in some special cases, it is exceedingly well adapted.

We present an illustration of the apparatus constructed by M. d'Arlincourt, which may easily be understood by reference to the foot-notes and to the above general description. The engravings on another page represent several writings and drawings which were actually transmitted, through the apparatus, from one instrument to the other, and which could, as we are told, have been transmitted, by the same means, a distance of two hundred miles. One of these supposed messages was supplied by a member of the Chinese Legation in Paris, who visited the Paris International Exhibition. The other drawings, probably by the hand of a French military engineer, who may have come among other visitors to M. d'Arlincourt, are such as might be made to give serviceable information during a siege, of the position of the parallel lines of intrenchments, and of the siege-gun and mortar batteries engaged in the attack of the fortress. These matters are signified by the written words, with alphabetical references, which appear on the drawing. The remaining sketches afford an exterior view, and an internal transverse section, of a gun turret erected in some land fortress, the construction of which it is desirable to explain, by a telegraphic message, to some person at a long distance, perhaps in a foreign country. It is imagined that a spy in time of war, if not a newspaper Special Correspondent, might possibly avail himself of the Automatic Telegraph to send plans or sketches of military preparations. We should much prefer to see this ingenious contrivance applied to peaceful and innocent purposes, whenever it is made ready for practical use.

a is a box containing wheelwork, driven by two mainsprings, which give motion to the metallic roller *b*. The train of wheelwork is governed by the vibrating spring *c*, in the same manner as the type printing instrument of Professor Hughes. In addition to this vibrating spring, a similar one, *d*, is fixed next to it, in the same standard, but is not in direct communication with the wheelwork. It receives its motion from the spring *c*, simply by the vibrations communicated by the latter, through the standard on which the springs are fixed. These springs are so adjusted, at each end of the wire, that their speeds are tolerably alike. The tinfoil paper for transmitting, or the prepared chemical paper for receiving, is fixed on the roller *b*. The metallic



D'ALINCOURT'S COPYING TELEGRAPH APPARATUS.

steel style in each case moves longitudinally and slowly along the cylinder by means of a screw, to which the standard holding the style is fixed. The roller *b*, at the sending station, stops automatically at each revolution, and is restarted by the roller at the proper time. By this means absolute synchronism is obtained, and there can be no accumulation of error. *e* consists of permanent and electro magnets; it forms a rapid relay by the line current, and it relays a current of sufficient intensity to discolour the chemically prepared paper. *f* shows the mechanical arrangement for the adjustment of the style in the proper place on the roller. *g*, end of same, showing its under side.

THE ELECTRIC LIGHT IN A CATHEDRAL.—A novel and interesting experiment was tried in Bristol on Thursday evening, Nov. 28. The Rev. Philip Sleeman, F.R.A.S., &c., took his electric light apparatus in the cathedral, and erected an electric lamp or regulator on Foucault's principle, on the top of the screen. It was intended more particularly to ascertain the effect of the electric light in illuminating the large open space immediately in front of the choir screen; but a good general idea was also obtained of the brilliant results which might be realised if the light could be applied on a sufficiently extensive scale for the illumination of the nave itself. This is the first time that the electric light has been introduced within the walls of a cathedral; and indeed, we believe within any sacred edifice whatever. It is just possible that this seemingly unimportant matter may be of historic interest. There was a great contrast between the electric light and the light of the gas. At the door of the east end of the new nave a person could read with these, whilst a person standing near the screen could but indistinctly see the letters of a book by the light of a gas standard with about fifty jets. So great was the power of the electric light that it then cast shadows of the gas lights upon the walls. The side aisles, however, were almost entirely in the dark, owing to the shadows of the pillars.—*Bristol Times and Mirror.*

THE ELECTRIC LIGHT.—At the time of the departure of the last mail from America, Mr. Edison had his new machine-house for testing the electric light nearly finished. This experiment, including everything, will cost £20,000, and the *New York Sun* points to this as a proof of the faith in the practicability of the invention. The well-known firm of Fabri and Chancery have bought from the Edison Company the exclusive right to use the new electric light in South America, and as the contract for Rio de Janeiro expires shortly, it is expected that that city will be the first in South America to be lighted by electricity. Mr. Edison says that he does not use carbon, and that his light does not burn itself out.

THE RAPIEFF ELECTRIC LIGHT.

This light has passed the experimental stage, and is actually employed in the printing office and composing rooms of the London *Times* newspaper.

The chief novelty of the system consists in the use of four carbons, instead of the two which, in nearly every other arrangement, form the points between which the luminous arc is produced. These carbon rods, instead of being placed parallel with one another, are so inclined that their points meet. Or to put the matter more clearly, the two upper carbons form the letter V, while the two others, forming the letter upside down Λ, are placed so that the combination represents an X. But the lower pair are set at a right angle to the upper. In plan, therefore, the four rods would form a cross.

One great advantage in M. Rapieff's system is that a nearly burnt out carbon may be replaced by a fresh one without any stoppage of the light. This operation, too, can be performed without the intervention of a skilled worker. In Fig. 1, page 58, the attendant—protected from the glare of the naked light by a small screen of colored glass—is in the act of replacing one of the negative carbons. The right hand lamp is shown as commonly used, with the light softened by a globe. The screw S, in both lamps, is the means whereby the distance between the two pairs of carbons is regulated and kept constant. Indeed, we understand that the size of the arc can be so adapted to the current

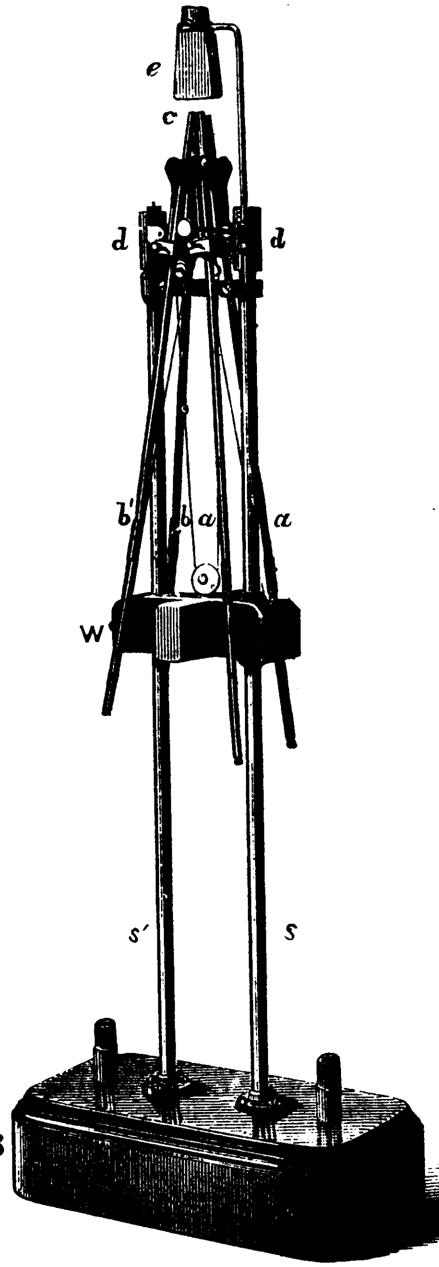


Fig. 3.—Modified Form of Rapieff Lamp.

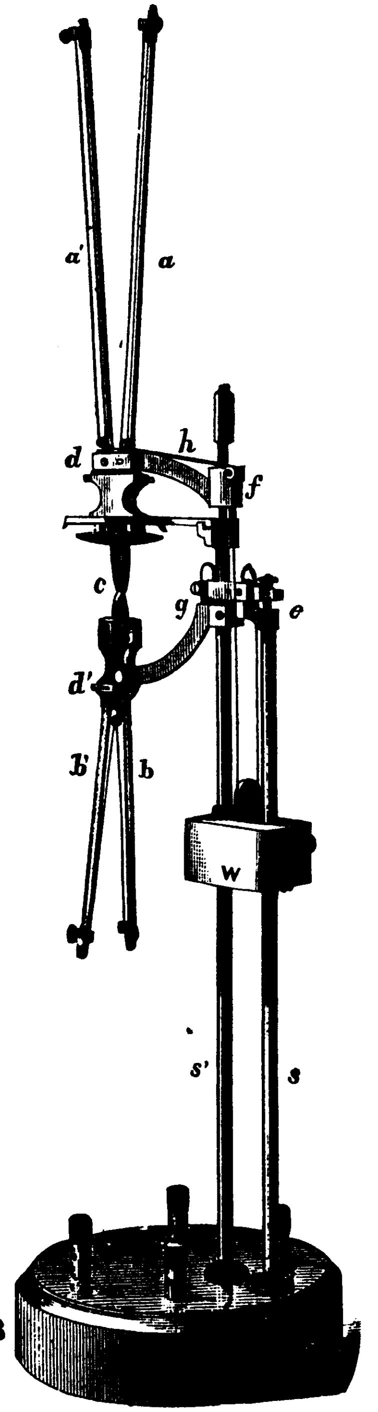


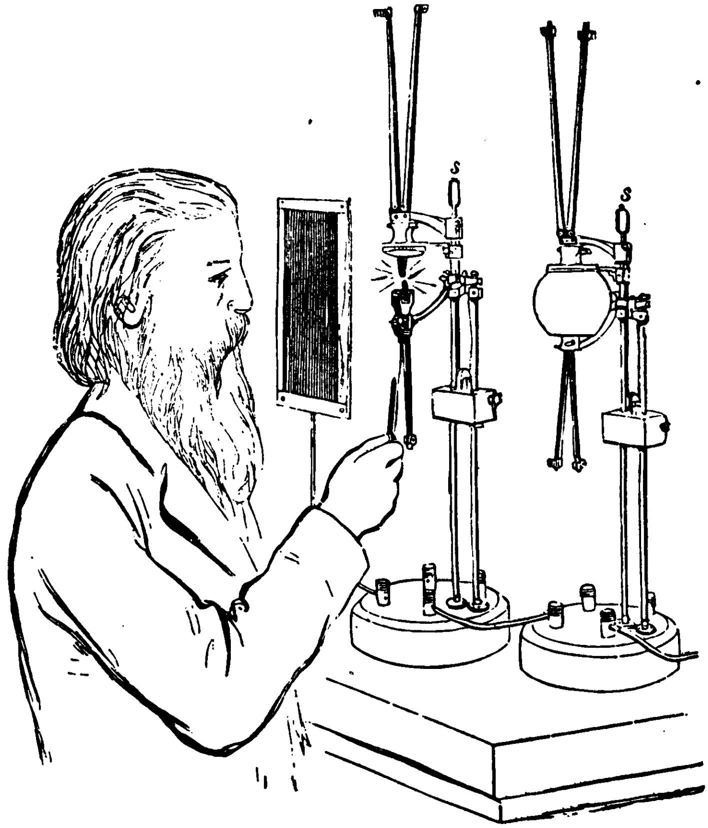
Fig. 2.—The Rapieff Electric Lamp

supplied, that a lamp can be made to represent the value of 100 gas flames, or of merely 10.

This system can be used with a magneto-electric machine of any pattern. The lights have each an independent existence, that is to say, one or two can be extinguished without affecting others in the same circuit. And the system offers the advantage of satisfactory subdivision without very great loss in the individual intensity of each light.

The carbons, as they consume away, are made slowly to approach each other, so that the arc is always of the same width, and keeps its fixed position in the space. To this effect the carbons are directed together over small pulleys at *d* (Fig. 2). The directing force is supplied by a lead weight or counterpoise *w*, of about three pounds, which slides down the brass stems *s s'*. The weight is supported by two silk or asbestos cords from the outer ends of the carbon sticks. In this way the descent of the weight draws the four carbons equally together as they are wasted away. A curved reflector of silvered brass or porcelain is fixed a little above the inner ends of the upper carbons. By means of the screws *f* and *e*, the width of the arc is adjusted, and by similar screws the angle at which the lower points face the upper ones can be varied, so as to direct the arc to one side or the other. The wooden base B carries four terminals for connecting the wire conveying the current. The base is hollow, and contains an electro-magnetic apparatus for starting the light. At first the carbon points are in contact, but when the current is put on, it passes through a dual electro-magnet in the base, the armature of which is attracted upward and pushes a rod up the hollow stem *s'*. This rod allows the lower carbon to drop away from the upper to the full width of the arc as previously adjusted. The positive and negative currents pass to their respective upper and lower carbons by means of the stem *s s'*, and the curved brackets. With carbons 20 inches long and 5 millimeters in diameter, the light is maintained for seven or eight hours, and with those 6 millimeters thick it is kept up for nine or ten hours. The light is equivalent to from 100 to 120 gas flames, or say about 1,000 candles. The smallest form of the lamp made gives a light estimated at five gas flames. M. Rapieff is now constructing a form of lamp made to burn upside down, in order that it may be fixed on the ceiling of rooms. Mica plates are sometimes used to screen off the heat from the cords when they are of silk. The resistance of the arc is only two or three ohms.

Fig. 3 represents a modified form of Rapieff's lamp. In it the carbons are simply inclined to each other at an angle which can be regulated by the same screws *d d'*. The width of the arc can also be regulated by the same screws. The carbons are drawn together by the descent of a counterpoise *w*, in a similar manner to that above described. In the lamp the planes of the carbon pairs are parallel to each other. A cylinder of lime *c*, is supported over the arc, and becoming luminous increases the illuminating power of the arc by about 40 per cent. The carbons M. Rapieff employs are made by M. Carré. The light is very pure and white, and can be considerably varied in intensity by the adjusting screws. Gramme's dynamo-machines are at present used in the *Times* office, but we believe that M. Rapieff has patented one of his own. There are six lamps in each circuit in the *Times* office, but M. Rapieff has successfully exhibited as many as ten.



Miscellaneous.

MAN'S AGE.

Few men die of old age. Almost all die of disappointment, passion, mental or bodily toil, or accident. The common expression, "choked with passion," has little exaggeration in it, for even though not suddenly fatal, strong passions shorten life. Strong-bodied men often die young; weak men often live longer than the strong, for the strong use their strength, and the weak have none to use. The latter take care of themselves, the former do not. As it is with the body, so it is with the mind and temper. The strong are apt to break, or, like a candle, to run; the weak to run out. The inferior animals that live temperate lives have generally their prescribed number of years. The horse lives twenty-five; the ox fifteen or twenty; the dog ten or twelve; the rabbit eight; the guinea-pig six or seven years. These numbers all bear a similar proportion to the time the animal takes to grow to its full size. But man, of all the animals, is one that seldom lives this average. He ought to live a hundred years, according to physical law, for five times twenty is a hundred; but instead of that he scarcely reaches on an average four times his growing period; the cat six times, and the rabbit even eight times the standard of measurement. The reason is obvious—man is not only the most irregular and intemperate, but the most laborious and hard-worked of all animals. He is also the most irritable, and there is reason to believe, though we cannot tell what an animal secretly feels, that more than any other animal, man cherishes wrath to keep it warm, and consumes himself with the fire of his own reflections.

PROMISED REVIVAL OF SODOM AND GOMORRAH.—It is reported that French capitalists have secured a grant for a railway line from Jaffa to the interior of Palestine, which will open up the Jordan valley and the whole region north of the Suez canal. In certain contingencies this road might become of great military usefulness, but it appears further that the productive resources of the country are considerable, and what is more surprising, that the Dead Sea itself can be turned to commercial account. Chief of these at present are the stores of natural combustibles for which that region is noted. Hitherto the main obstacle to the development of steam traffic in the Levant has been the total absence of combustible material. Not only Egypt, but the shores of Syria and the Red Sea are completely stripped of wood, and the coal imported from the West commands a price ranging from $10 to $24 a ton. Now the masses of asphalt continually thrown up by the Dead Sea attest the presence of vast subterranean layers of fossil vegetable matter, and these signs were not long overlooked by the enterprising men attracted to Suez by the opening of the canal and the movement of commerce in that direction. Recently numerous soundings have been made between Jaffa and the Dead Sea, which, so far, have not disclosed any deposits of coal proper, but, on the other hand, have laid bare inexhaustible beds of lignite. Of itself this store of lignite is likely to prove an inestimable gain to the industries and commerce of the Levant. It is very well known that similar bricks, made up of coal dust and bituminous debris from gas works, are much sought after by French railways, since, besides their heating power, they greatly facilitate stowage, owing to their regular shape. Of course the bitumen of lower Palestine has been known from immemorial times, and was used to impart solidity to the structures of unbaked clay in Assyria and Egypt; but it may be said that the discovery of the subterranean combustible has lifted once for all the curse which has so long rested upon Sodom and Gomorrah, and will transform the wasted shores of the Dead Sea into a focus of industry and a magazine of wealth.

MANUFACTURING IN FRENCH PRISONS.—Says the *Iron Age*: "There are twenty-one central prisons in France for prisoners with sentences of five years and over. The cellular system is adopted in prisons for the detention of prisoners not sent up for more than a year and a day; but in the central prisons as many as 100 men sleep in one ward, certain of their number being responsible for the preservation of order. The dormitories are lighted, and there are openings from the galleries through which the guards may inspect them. By day the men work in *ateliers*, 50 or 100 in each. Shoes, chairs, woven fabrics, buttons, umbrella-ferrules, Chinese lanterns, etc., are manufactured, and such light work as glossing paper, sewing copybooks, and making hair ornaments is done. The work is let to contractors by tariff, fixed by the local Chamber of Commerce, to prevent any undue competition with free labor. Half of the profits of the prisoner's work goes to the State; he is allowed to spend a quarter in procuring special articles of diet, etc., and the remaining quarter is paid to him on leaving, so that a discharged convict often finds himself with from $100 to $300 cash capital. A large proportion of the prisoners use this in setting themselves up in trade, or in procuring passage to other countries. These rewards of industrial labor, together with the industrial training itself, constitute together the main and tolerably effectual counterbalance to the otherwise grave evils of association. The element of hope is always prominent in French prisons, and it is the sheet-anchor of their administration. A visitor to La Santé, at Paris, observed in the first cell he inspected a table on which lay a pipe of tobacco, a half bottle of wine, and a novel."

Life-Preserving Bulwarks.—At a recent meeting of the Manchester (England) Mechanical Society, Mr. Gadd proposed to form the upper portion of the bulwarks of ships of loose sections composed chiefly of hollow thin metallic tubes divided into compartments by diaphragms, the sections to be about 12 feet long, each to be divided into a number of compartments of any suitable form, and provided with projections on their under sides so as to be fitted on to the place of the top rail of the bulwarks, and to be a substitute therefor. These sections when immersed in the water would form so many pontoons, and would be provided with cords and loops along their sides, and in the event of the ship going down would be lifted out of their place by the action of the water. He would also construct the whole of the seats on the deck in the same manner, and underneath every seat, and along the entire length of the bulwarks and lying on the deck, other floating tubes could be provided. In the case of sea-going vessels, he would fit the bulwark tubes with holes, rings or slots, so that in case of foundering they could be jointed together either before or after taking to the water. The great advantage of this arrangement would be that it would be in perpetual readiness for any sudden emergency, and there was no doubt that vessels could be readily fitted in this manner.

The Ulikon, or Candle Fish, of Alaska.—The ulikon has long been an ichthylogical curiosity, and has attracted the attention of every traveller who has visited the coast of British Columbia and Southern Alaska. It is a small silvery fish averaging about 14in. long, and in general appearance resembles a smelt. They are the fattest of all known fishes, and afford a superior oil when dried out. Dried they serve as torches, and when a light is required it is only necessary to touch the tail to the fire when they will burn with a bright light for some time. No description can give an adequate idea of their numbers when ascending the rivers from the sea. The water is literally alive with them, and appears to be boiling. These fisheries have not been utilised except by the natives. The most important of the native fisheries is on the Nasse river, near the southern boundary of Alaska. The spot is named "Kit-lak-a-laks," and a Catholic mission was situated there. Many tribes come to these fisheries which begin about the 20th of March. The first fish caught is addressed as a chief, and many apologies are made to him by the Indians for the necessity which compels them to destroy his kindred for the supply of their own wants.

A New Polar Island.—The discovery of a new island in the Polar Seas is announced by the following telegram from Tromsö:—"E. Johanessen, who has just returned there, reports that he penetrated a considerable distance to the east, beyond Novaia Zemlya. On September 3, in longtitude 66* E. and 77* 35' N. latitude, he discovered an island which he has named 'Ensomheden' (loneliness). It is about 10 miles long, and level, the highest point not exceeding 100ft. It was free from snow, with poor vegetation, but an immense quantity of birds. The sea was free from ice towards the west, north, and south, but drift ice was seen towards the south-east. There was evidence that the Gulf Stream touched the west coast of the island; the stream runs in a strong current round the north coast towards the south-east. Everything about the ice was favourable for navigation so long as the vessel did not go too near the mainland of Siberia." The newly discovered island lies, therefore, somewhat to the south-east of the region visited by the Austrian Expedition of 1873-4.

A New Signal of Warning for Dangerous Coasts.—A foreign journal, translated by the *Iron Age*, describes a new method of giving signals of warning at sea that has recently been perfected, and is now employed with success at one of the most dangerous points on the coast of Bretagne. The signals consist of sounds, which are repeated at short intervals, and can be heard, even against the wind, at a distance of six kilometers. The apparatus by which these sounds are produced is self-acting and very simple. It consists of a hollow cylinder, a few centimeters in diameter, and three or four meters long, closed at the lower end and secured by an anchor to the bottom of the sea. In this cylinder is found a pump which sucks in the air, compresses it and sends it out through a whistle, and this pump is worked by a huge fagot, floating on the surface of the sea, and whose movements, rising and falling with the waves, furnish the sufficient force. This apparatus is said to have been invented by an American.

Cheap Carriage of Parcels.—A great advantage to the public in the transport of parcels is promised shortly. Twenty-five companies of England, Scotland, and Wales have resolved to issue, from and after the 1st of January next, railway stamps to the public, of the denominations of fourpence and eightpence, which shall carry parcels of two pounds and four pounds, respectively, throughout their whole systems, and have agreed to accept parcels at these weights and at these rates throughout the whole of their systems, and to grant an insurance up to 20s. at these rates, thus placing all the stations on these twenty-five companies at the command of the public, for the receipt and delivery of parcels not exceeding four pounds in weight. Four English companies have refused to accept parcels at these rates, and a public meeting is to be held in London to induce them to join in the action of the rest, and to urge upon the Post Office to cooperate in the movement.

Extraction of a Living Insect from the Ear. — The *Archives Médicales Belges* relate the following case: A little girl, three years old, put an insect, "*bête du bon Dieu*," into her ear. Sharp cries, agitation and convulsive symptoms ensued. Injections of water were made without result. The physician then conceived the idea of asphyxiating the insect by means of chloroform; he dropped four drops of chloroform upon a small piece of cotton, which he introduced into the ear. Immediately the child ceased crying and complained no further of any disagreeable sensation; the insect had become asphyxiated; an injection of warm water brought it away dead, and no further trouble ensued.

The authorities of the Trinity House have been making experiments with a new gas which has been brought under their notice as being not only cheaper than ordinary gas, but far more effective. This new gas is capable of so much concentration that a quantity contained in a small buoy has kept a light burning for twenty-eight days with sufficient brilliancy to show the position of the buoy from passing ships. The inventor declares that a buoy of ordinary size would contain sufficient gas to keep a good light burning for nine months, so that all our buoys might show lights at night if gas were supplied to them twice in a year and a half.

Marble Cements.—A composition of gumlac, colored to suit the occasion, is sometimes used. The rust cement is also used, composed of hydrochlorate of ammonia, 2; flour of sulphur, 1; iron filings, 16. For coating inside of cisterns: Pulverized baked bricks, 2; quicklime, 2; wood ashes, 2; olive oil to make a paste. For stone seams and joints: Pulverized tiles or hard brick, 6; white lead, 1; litharge, 1; oil to compound. Another cement is as follows: Hydraulic cement, 12; triturated chalk, 6; fine sand, 6; infusorial earth, 1; all mixed with soluble soda glass.

Mahogany Superseded. — Mahogany, heretofore the chief source of wealth in British Honduras, was during 1876 of such small value as not to repay the expense of cutting, and never probably since the occupation of the colony, with the solitary exception of the year 1870, was so little of this wood exported. Of logwood, on the other hand, owing to the exceptionally high prices of 1875, more was sent home during 1876 than in any year since 1864. In 1875, 1,587 tons of logwood, valued at £6,348, were shipped from the island of St. Lucia.

It is stated that the Admiralty have decided to adopt the use of anchors made of Bessemer steel, which can be had at less than one-half of the price paid for the costly "best" iron hitherto used; but it yet remains to be seen how far the quality will be the same. This extension of the area in which Bessemer steel is now used is likely to be of great value to the steelmakers, if the experiment prove successful, and to have important effects on the chain and anchor trades.

The farmers of Langley, Canada, offer a bonus of $2,000 to any party undertaking to erect a mill containing two run of stones for wheat and one for oatmeal.

Machine Construction & Drawing.

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

CHAPTER V.

(*Continued from page 28.*)

A line perpendicular to the vertical plane, and above the horizontal plane, is shown by *d'e'*, *de* is the plan of the line. In figs. 26, 27, the planes are shown by two views, fig. 27 being a front-elevation, and fig. 26 an end-elevation; the lines *ab*, *de* are similarly situated to those in fig. 25. *a'b'* is an elevation of *ab*, *d'e'* an elevation of *de*. The *plan* of *ab* is a point, the *elevation* of *de* is also a point.

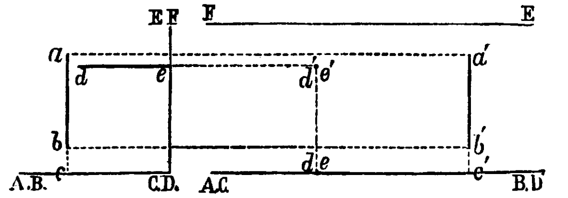


Fig. 26. Fig. 27.

15. To explain the several terms employed for different views of an object, and to show how these views are obtained, we shall use the object shown in figs. 28 to 31, Plate II. The student is requested to pay particular attention to this part of our subject, and thoroughly to understand it before proceeding to the application of the principles here laid down.

The figure is a prism, whose base is a square upon which it rests, on the horizontal plane (ground); on three faces are placed small prisms differing in length and height, producing an object not symmetrical, as better suited for our purpose. Fig. 28 is a *plan*, that is, a projection on a horizontal plane. Fig. 29 is an *elevation*, that is, a projection on a vertical plane situated at AB; the plane is then turned through a right angle, along the line AB (ground line) as an axis, giving the elevation in the position indicated by fig. 29; the arrow shows the direction of projection, the observer being situated at E. If now we wish to have a view of the object as seen from F, erect a vertical plane at AD, and project an elevation on this plane; now turn the plane into the position AD', and we have the elevation shown by fig. 30. Fig. 31 is an elevation projected on the plane BC, the observer being at G.

Figs. 30 and 31 may be projected similarly to fig. 29, as shown in figs. 32, 33, 34. Fig. 34 is a projection on the vertical plane AD, which is turned into a *horizontal* position, giving the elevation as shown. The same elevation is obtained in figs. 30 and 34, the only difference being one of position; both methods are employed, convenience generally deciding which is to be adopted; the former, however, is the one chiefly employed. The circular dotted lines shown in the figures need not be put in your drawings after becoming familiar with the principles laid down.

16. The elevations obtained in figs. 30, 31, are the same, both in form and position, as would be obtained if we were supposed to be looking at fig. 29 in the directions H and K respectively, and saw it projected on the vertical planes at AD'', BC''. From these remarks the student will understand that *the position of the object is between himself and its projection;* and when one elevation is projected from another, as fig. 30 from fig. 29, the given elevation and the projection are in the same order as before, calling the given elevation the object; for example, if the observer is at H, fig. 29, looking towards the figure, and wishes to draw the elevation as seen by him in that position, the elevation must be placed in the position occupied by fig. 30; similarly an elevation in the direction K would be placed as fig. 31.

In practice it is sometimes inconvenient, owing to the size of one of the elevations, to follow out this order correctly; in such cases figs. 30 and 31 change places; this should, however, be considered only as an exception. The student is recommended to follow out strictly the order indicated, as it will save him much time and trouble, and make the study of projection more natural to him, and will, at the same time, remove one source of error which he is liable to fall into.

Fig. 28 is a plan; fig. 29 a front-elevation; figs. 30 and 31 end or side-elevations. The term "*view*" is often used instead of "*elevation.*"

CHAPTER VI.

THE examples in this chapter may be used as drawing exercises, the figures to be drawn full or half size.

17. We will now apply the foregoing principles to the representation of various pieces of machinery, &c.

Nuts.—Figs. 35 to 37, Plate III., are elevations and plan of an ordinary *hexagonal nut* for a bolt 1'' diameter, as represented in *scale-drawings*; the elevations are not quite correct, but are good approximations. Fig. 35 is the plan; fig. 36 the front-elevation; fig. 37 an end-elevation. The construction lines clearly indicate how each view is obtained. In figs. 36 and 37 the curves *a'b'* are considered as arcs of circles; their true form will be considered in the following figures. The greatest and least diameters of the nut are taken from a table of *Whitworth Standards*, a copy of which, with a few additions, is here given (see Table I.). The thickness of the nut (*t*) is equal to the diameter of the bolt. We shall not give dimensions of nuts in the details to follow, but refer the student to the table given. For ordinary scale drawings, sufficient accuracy will be obtained in drawing nuts if we take the following as a rule for nuts for bolts under $1\frac{1}{2}''$ diameter, viz., make the diameter across the angles = two diameters of the bolt. In figs. 38-41 we show the nut given in the preceding figures drawn full size; in this example the nut is *turned* on the top face and *chamfered;* there are two common ways of chamfering, that forming a *conical outline,* and the one shown, which has a *spherical outline,* the radius of the sphere equalling *r* in figs. 38, 39, 41. By a spherical outline we mean that the chamfered surfaces *a'e'*, *b'f'*, &c., would touch the inner surface of a hollow sphere of radius *r*. All sections of the sphere being circles, that made by the vertical plane $v_1 s_1$, containing the face *a'b'c'd'*, will be a circle of radius *r'* and $= \frac{1}{2}$ the greatest diameter of the nut; the curve *b'a'* is part of this circle. The six faces are all equal, it therefore follows that the curves *a'b'*, *b'a'* are also equal; but as those marked *a'b'* are inclined to the vertical plane (at 60° in figs. 38, 39, and 30° in figs. 40, 41), their projections, *a'b'* in figs. 39, 41, will not be portions of circles, but of ellipses;* their construction is shown in dotted lines. Arcs of circles may be substituted for the portions of ellipses *a'b'*, the error being small.

* The plates referred to will be found in the next number.

TABLE I.

A TABLE OF THE SIZES* OF WHITWORTH STANDARD HEXAGONAL NUTS.

Dia. in in.	Dia. across flats (d) In Decimals.	Dia. across flats (d) To nearest 1/32 of in.	Dia. across angles (c) In Decimals.	Dia. across angles (c) To nearest 1/32 of in.	Dia. in in.	Dia. across flats (d) In Decimals.	Dia. across flats (d) To nearest 1/32 of in.	Dia. across angles (c) In Decimals.	Dia. across angles (c) To nearest 1/32 of in.
1/2	·9191	29/32	1·0612	1 1/16	1 1/2	2·4134	2 13/32	2·7867	2 25/32
5/8	1·101	1 3/32	1·2713	1 9/32	1 3/4	2·7578	2 3/4	3·1844	3 3/16
3/4	1·3012	1 5/16	1·5024	1 1/2	2	3·1491	3 5/32	3·6362	3 5/8
7/8	1·4788	1 1/2	1·7075	1 23/32	2 1/4	3·546	3 17/32	4·0945	4 3/32
1	1·6707	1 11/16	1·9291	1 15/16	2 1/2	3·894	3 29/32	4·4964	4 1/2
1 1/8	1·8605	1 7/8	2·1483	2 5/32	2 3/4	4·181	4 3/16	4·8278	4 13/16
1 1/4	2·0483	2 1/16	2·3651	2 3/8	3	4·531	4 17/32	5·2319	5 7/32

* There are intermediate sizes which are not enumerated in the Table.

18. Figs. 42, 43, represent the nut circumscribed by a hemisphere of radius r in former figures; in the plan, fig. 42, are shown two section planes $v_1 s_1$, $v_2 s_2$, each containing a face of the nut, as $v_1 s_1$ in fig. 38. On the left of the centre line in fig. 43 is shown one-half of the face contained in the plane $v_1 s_1$, together with the portion of the sphere cut off by the same plane. On the right of the same figure the face contained in the plane $v_2 s_2$ is shown; the remaining portion of the sphere cut by the plane is distinguished by section lines,† as in the left-hand portion of the figure; the construction lines will explain how to draw fig. 43.

Fig. 43.

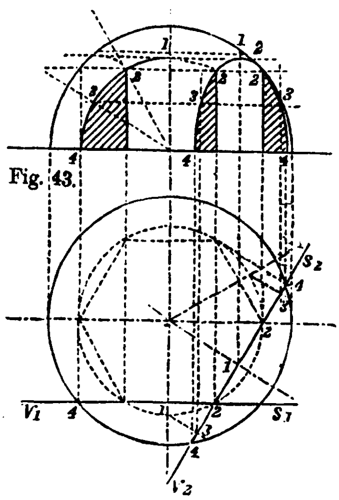


Fig. 42.

19. The terms *plan* and *elevation*, as employed for figs. 35-43, and for all details or parts of machinery, are only intended to apply in the cases represented; where we consider the object as a whole; for instance, in a machine we may have *nuts* in various positions, plans, and elevations, in the same elevation of the machine; in that case we speak of the plan or elevation of the machine as a whole, and not with respect to its individual parts. Therefore, when we speak of the plan or elevation of a piece of a machine, we do not assert that that plan or elevation is always a plan or elevation; for what we term a plan in one case, may be an elevation in another.

* The projection of a circle upon a plane, making an angle with the plane of the circle, is an ellipse.

† We shall distinguish the cut surfaces or sections of objects by diagonal lines, as in fig. 43.

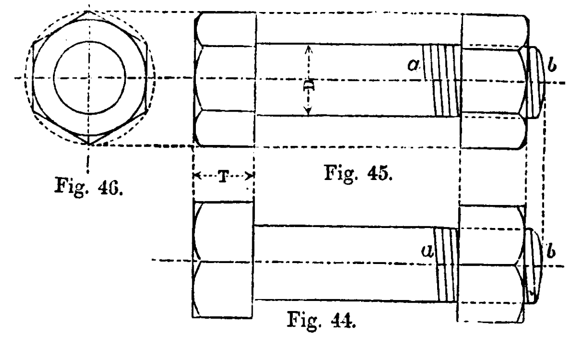


Fig. 46. Fig. 45. Fig. 44.

20. **Bolts.**—Figs. 44, 45, and 46 are three views of an ordinary $1\frac{1}{2}''$ bolt with hexagonal head and nut drawn to a scale of $\frac{1}{4}$. Fig. 44 is a plan; fig. 45 a front-elevation; and fig. 46 an end-elevation, showing the screwed end of the bolt and the nut. The screwed part ab is not correctly represented in the figures, but is shown as is usual in small scale drawings; we shall consider the true form under the title of screws. The thickness of the *head* $T = \frac{7}{8}$ of the diameter D of the bolt. Bolts are used for the purpose of connecting two or more pieces of material, and are made of various forms. Figs. 47, 48 illustrate a common form, the head a is square, the portion b next to the head is also square, and fits into a square hole, which prevents its turning round while the nut is being *screwed* on; the diagonal lines on a and b are used to denote its form (usually only shown in working drawings) when an end-view is not shown.

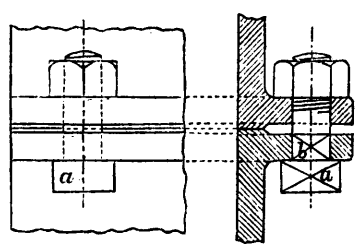


Fig. 47. Fig. 48.

Fig. 48 is in section. The figures are drawn to a scale of $\frac{1}{4}$.

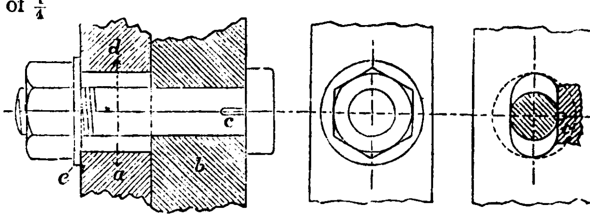


Fig. 49. Fig. 50. Fig. 51.

21. Figs. 49, 50, 51 represent another mode of connecting two pieces by a bolt. In this example the piece a can receive a small change of position in direction ad; the bolt is prevented from turning by the *pin* or *key* c; e is a *washer*. Fig. 49 is a sectional elevation made by a plane passing through the centre line of fig. 50. We do not show the bolt in *section*, as its shape is shown more clearly by not doing so; this is the usual form adopted. Fig. 50 is an end-elevation; fig. 51 an end-elevation with the bolt in section, showing form of hole in a and pin c. Such a section is sometimes termed a *cross-section*, and fig. 49 a *longitudinal-section*.

(*To be continued.*)

Health and Home.

HINTS FOR HOUSE-CLEANERS.

We give below a few hints which may prove useful to housekeepers:

Soot falling on the carpet from open chimneys, or from carelessly handled stove-pipes, if covered thickly with salt, can be brushed up without damage to the carpet.

A little spirits of turpentine added to the water with which floors are washed, will prevent the ravages of moths.

When carpets are well cleaned, sprinkle with salt and fold; when laid, strew with slightly moistened bran before sweeping; this, with the salt, will freshen them wonderfully.

Fuller's earth, mixed to a stiff paste with cold water, spread on the carpet, and covered with brown paper, will in a day or two remove grease spots; a second application may be necessary.

Spirits of ammonia diluted with water, if applied with a sponge or flannel cloth to discolored spots in carpets or garments, will often restore the color.

A paste made of whiting and benzin will clean marble, and one made of whiting and chlorid of soda, spread and left to dry (in the sun if possible) on the marble, will remove spots.

Paint splashed upon window-glass can be easily removed by a hot solution of soda.

Use kerosene and bath-brick or lime, to scour zinc, tin or copper; wash in hot suds, and polish with dry whiting.

To give glass great brilliancy, wash with a damp sponge dipped in spirits, then dust with powdered blue or whiting, tied in a thin muslin bag, and polish with chamois cloth.

A flannel cloth dipped in warm soapsuds, then into whiting, and applied to paint, will instantly remove all grease and dirt. Wash with clean water, then dry; the most delicate paint will not be injured, and will look like new.

One pound of copperas dissolved in one quart of boiling water will destroy foul smells. Powdered borax scattered in their haunts will disperse cockroaches.

Plaster of Paris mixed with gum arabic water makes an excellent white cement, but must be used immediately, as it hardens quickly. A mixure of five parts gelatin to one of acid chromate of lime, applied to broken edges, which should be pressed together and exposed to the sunlight, makes an insoluble cement.

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

To clean matting, wash with a solution of one pint of salt to four gallons of water, and wipe dry immediately.

To clean oilcloths, wash always with warm milk. One in six months scrub with hot soapsuds, dry thoroughly, and apply a coat of varnish. They will last as long again.

A little kerosene added to stove-polish improves the luster. Apply while the iron is warm.

To remove spots from furniture take four ounces of vinegar, two of sweet oil, and one of turpentine; mix and apply with a flannel cloth.

Gum camphor wrapped in paper and laid around sugar barrels will disperse ants.

THE PRIME OF LIFE.

Between the age of 45 to 60, a man who has properly regulated himself may be considered in the prime of life. His matured strength of constitution renders him almost impervious to an attack of disease, and experience has given soundness to his judgment. His mind is resolute, firm and equal; all his functions are in the highest order; he assumes mastery over his business; builds up a competence on the foundation he has laid in early manhood, and passes through a period of life attended by many gratifications. Having gone over a year or two over 60 he arrives at a standstill. But athwart this is the viaduct called the turn of life, which, if crossed in safety, leads to the valley of "old age," round which the river winds, and then beyond, without boat or causeway, to effect his passage. The bridge is, however, constructed of fragile material, and it depends how it is trodden whether it bend or break. Gout and apoplexy are also in the vicinity to waylay the traveler, and thrust him from the pass; but let him gird up his loins and provide himself with a fitter staff, and he may trudge on in safety and with perfect composure. To quit metaphor, "the turn of life" is a turn either into a prolonged walk, or into the grave. The system and powers having reached the utmost expansion, now begin either to close like a flower at sunset or break down at once. One injudicious stimulant, a single fatal excitement, may force it beyond its strength, whilst a careful supply of props and the withdrawal of all that tends to force a plant will sustain it in beauty and vigor until night has entirely set in.

DANGER OF FLIES IN THE EAR.—Dr. A. J. Pedlor, of Truckee, Cal., writes to the *Pacific Medical and Surgical Reporter* a description of a case which fortunately is of rare occurrence. He says: On the 11th of June, I was consulted by John R., a stock drover, who complained of excessive pain and violent noise in his left ear. He said, "A fly entered my ear five days ago, but I got it out in *two minutes.*" Ten hours after removing the insect, pain set in and rapidly increased. The old-time remedies of filling the ear with warm water, oil, &c., failed to remove anything, and gave no relief. Inserting a speculum, and illuminating the ear with a Troeltsch mirror, the cause of his suffering was plainly visible. A number of moving worms, or maggots, were seen imbedded in the canal, close to the drum. Careful use of the syringe for one hour resulted in removing one maggot, about three lines in length. The ear was then filled with carbolized almond oil, containing morphia sulph. A cotton plug being inserted, the patient went to bed. During the night four more maggots were dislodged, and the following morning I removed the sixth and last one by aid of the syringe. This last one was fully six lines in length. Three came away dead—the effect of the carbolized oil. These wriggling usurpers were evidently hatched from eggs deposited by the "fly," during its brief sojourn in the ear. The drum was intact, though intensely hyperemic. Daily use of astringent drops, and protection from the air, speedily restored the parts to health.

THE SCIENCE OF LIFE.—How few of us acquire this science until we are old enough for life to have lost half its charms! The science of life consists in knowing how to take care of your health, how to make use of people, how to make the most of yourself, and how to push your way in the world. These are the things which every body ought to know and which very few people do know. How never to get sick, how to develop your health and strength to the utmost, how to make every man you meet your friend, how to attach a few people to you as your bosom-friends to be relied on in every case, how to earn money and save it, how to behave just as you ought to behave amid all the contingencies and unforeseen happening of life, how so to live down your past if it is of such a character as to demand being lived down, how to manage yourself as to escape the entanglements of bad women and sincere friends, how to provide yourself, if you wish to do so, with a wife that will not be a burden and shame to you all the rest of your life, how to approach old age gracefully, so that you will not be a grief and reproach to yourself or others, how to make use of past errors and crimes, so that they may prove a help rather than a hindrance to you in the future; all these and many other things are to be included in the science of living, and the pity is that we only appreciate that science at its true value when the bloom of life is gone.

HYGIENIC BISCUITS.—An exchange gives a recipe for making a biscuit which shall accord with advanced hygienic ideas concerning the composition of flour, &c. On a baking board put two pounds of oat meal and two pounds whole wheaten flour, ten ounces of good salt butter, one-half ounce carbonate of soda, one-fourth ounce tartaric acid, and four ounces of sugar. All should be weighed carefully; the butter should be the best that can be procured, and the soda should never be used without the acid. Mix all together. When the butter has been well rubbed into the flour, add buttermilk, mixing with the hand till of a pasty consistency. Knead just as little as possible, to keep the double light. Roll out; cut with biscuit-stamp to the required size, prick with marker, and fire in a moderately quick oven. In the absence of a stamp cut with a lid; and if no marker is at hand use a common fork. In rolling out the biscuits little or no fresh flour should be used; otherwise the brownish color of the biscuit will be lost. When firing in the oven, biscuit trays should be used. Any wireworker will make one. If these directions are followed, a most palatable, agreeable, and nutritious bread will be produced. If cooled in an open basket, and afterward stored away in tins, these biscuits keep sweet and short for a considerable period.

How Diphtheria was Spread.—A few weeks ago a little girl in St. Albans, who had just recovered from diphtheria, was taken by her parents to visit a family in the neighboring town. She slept with the children in that family, and shortly afterward three or four of them were taken with the malady, and some have since died. The family permitted relatives and neighbors to visit them, and the result is several cases in the neighborhood. They had public funerals, even keeping the remains of one child an unusual time, waiting for another to die, so as to bury them together; and this also spread the contagion. The physician was not powerfully impressed—as some physicians are not—with the contagious character of the disease; therefore, he did not take the necessary precautions for the protection of the neighborhood or of his own family, and the result is that one of his own children has died and another is dangerously ill. A lady who went to one of these houses to robe the victims for the grave has called at houses in the vicinity where there are children, without any change of her garments or any attempt at disinfection, and has fondled the children in those families, apparently in utter ignorance of the danger to which she was exposing them.

The last and saddest instance was that of H. R. Highness the Princess Alice, who took the kiss of death from her own child.

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

Ventilation of Cupboards.—The ventilation of cupboards is one of those minor matters that are frequently overlooked in the erection of houses, while the want of a thorough draft is apt to make itself unpleasantly apparent to the smell. The remedy of the defect is, however, very simple; if possible, have perforations made through the back wall of the closet, and a few in the door; when the wall of the closet cannot be perforated, bore holes freely on the top and bottom. To prevent dampness, with the accompanying unpleasantness and injurious effects of mildew in cupboards, a tray of quicklime should be kept, and changed from time to time as the lime becomes slacked. This remedy will also be found useful in safes or muniment rooms, the damp air of which is often destructive to valuable deeds and other contents.

Treatment for a Sprained Ankle.—Dr. Erasmus Wilson says: "We all know that there is nothing more painful than a sprain of an ankle; it will lay a man up longer than the fracture of a bone, and he may recover with a very weakened joint. Accompanying a medical man in his rounds, he told me he had made a great discovery in the treatment of sprains. 'The way I cure a sprain,' he said, 'is this: I take some lard; I warm it, and rub it into the sprain half or three quarters of an hour. I then take some cotton wool and wrap around the joint and put on a light bandage. The sprain, which would have taken many months to get well, gets well in a few days—certainly in a few weeks—without any ill effects or after-consequences.'" Wilson adds: "I tried this treatment and found that it succeeded admirably."

Falling Hair.—A correspondent of the *Medical and Surgical Reporter* asks: What will prevent the falling of hair? I have used for the past ten years, in my own case, and prescribed frequently for others, the following with complete satisfaction; Glycerin and tincture capsicum, each 2 ozs oil of bergamot, 1 drachm; mix and perfume to suit. This is to be the only dressing for the hair. Wash the head occasionally with soft water and fine soap.

The Orange.—The orange is very easily digested, admissible in health and disease, and one before breakfast will often prepare the delicate stomach for a good meal better than anything else.

COOKERY.

Potted Ham.—In warm weather it is difficult to keep ham that has been cut. The following plan is safe and good: Cut all that will make good slices, and fry as for the table. Lay the pieces close and even in a stone jar, packing them snugly and pressing them down. Pour all the hot fat over them, to fill the spaces and exclude air. Lay a plate over the top with a stone upon it. Keep in a cool, dry place, and you will find it nice and convenient all through warm weather. When wanted for the table, lay slices in the frying-pan, and only heat them through without more cooking. Be careful to keep the top of the jar covered carefully, so that flies may never gain an entrance.

How to Bake a Ham.—A good way to cook a ham is to bake it. Soak about twelve hours. Wash very clean, trimming away any rusty parts. Wipe dry, and cover the part not protected with skin, with a paste or dough made of flour and hot water. Lay in a dripping-pan, with the paste-covered side upwards, with enough water to keep it from burning. Bake until a fork pierces it easily, allowing about twenty-five minutes to each pound of the ham. Baste occasionally with the drippings, to prevent the crust of paste from cracking off. When done, peel off this crust and remove the skin of the ham. It may be served as it is, or it may be glazed.

To Glaze a Ham.—Brush the ham over with beaten egg. To a cup of finely powdered cracker, allow enough rich milk or cream to make into a thick paste, add a little salt, and work in a teaspoonful of softened butter. Spread this evenly over the ham, a quarter of an inch thick, and set it in a moderate oven to brown.

We have unavoidably been obliged to postpone the continuation of the illustrated article on "How to paint in oil on unglazed pottery," which appeared in our January issue. The remainder will appear in March number.

We shall be happy to afford information to any of our readers desiring to obtain the vases and materials for the purpose of practising the art of decorating these elegant designs from the Antique.

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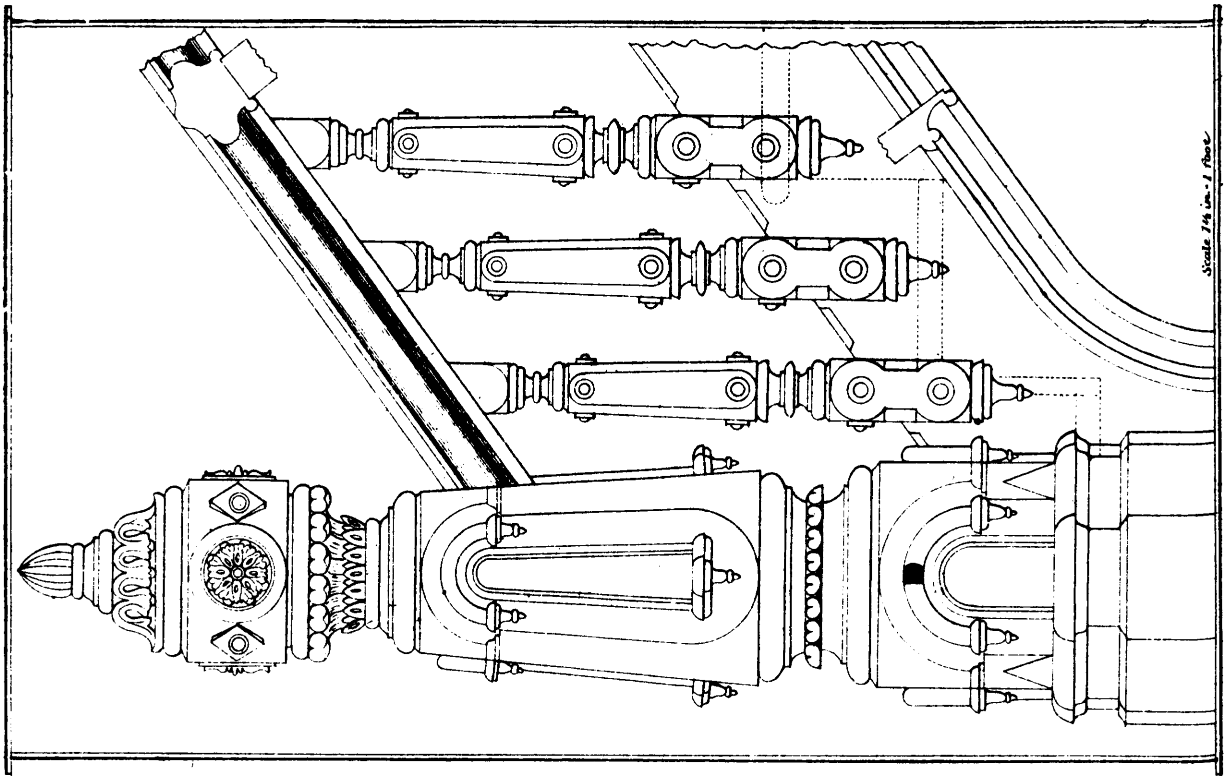

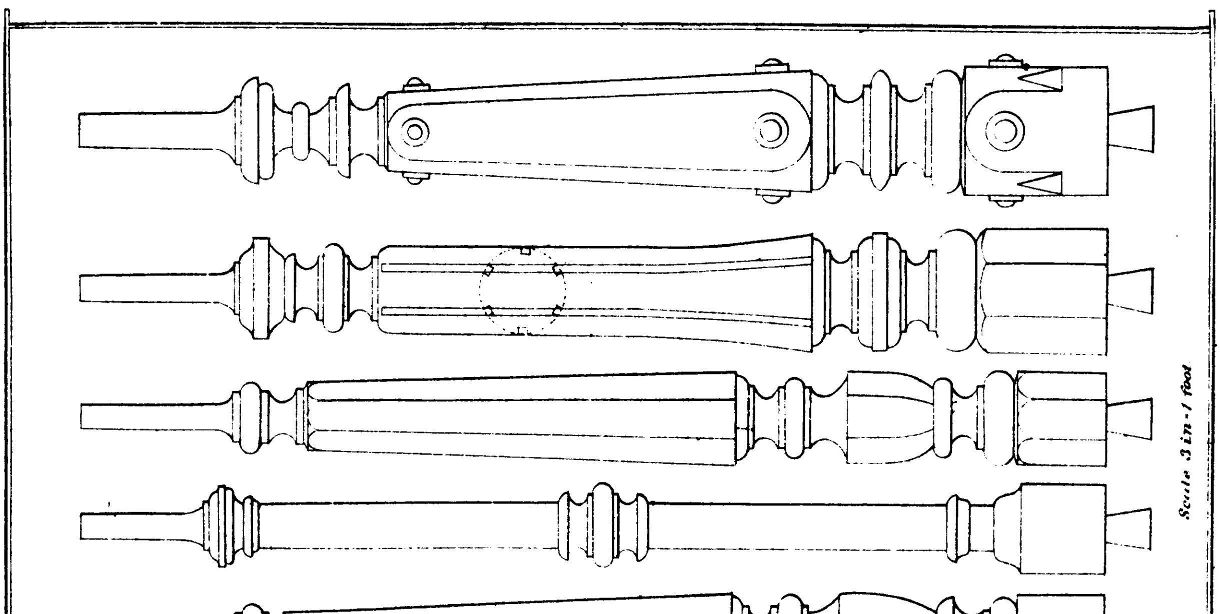

CARPENTRY: DESIGNS FOR NEWELS AND BALUSTERS.