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SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE
AND
PATENT OFFICE RECORD

Vol. 7. APRIL, 1879. No 4.

OUR SELF-MADE MEN.

LOUIS CÔTÉ, ESQ.—A REMARKABLE CANADIAN INVENTOR AND MANUFACTURER.

THE talented gentleman, whose portrait we give in this number, was born at Saint Dominique — a village in the County of Bagot — in the year 1836. His father was of that humble and upright class of Canadian farmers whose small inheritage had descended to them from one generation to another, and who probably intended that their son should walk in the same sphere of life and become a cultivator of the soil. But at a very early age the boy showed a remarkable taste for mechanics, so much so, that when at school, he amused himself between the leisure hours of study, in drawing designs and figures upon his slate, and devoted his holiday time in constructing miniature mills, and damming up the water courses in ditches to obtain a power to work his crude machinery. The genius so early exhibited for mechanics induced his parents to place him, when fourteen years of age, with an uncle residing at St. Hyacinthe, to learn the shoemaker's trade. Here the boy gave his mind ardently to his trade, and was noted for the superiority of his work over that of other apprentices. The want of education, however, bore heavily on his mind, and even at this early age he severely felt the need of obtaining a higher degree of education than that to be obtained from a country schoolmaster 29 years ago, and that there was an opening for vast improvements in the tools and appliances for manufacturing boots and shoes. At St. Hyacinthe, there is established a College, and is it any wonder that, with a mind thirsting for knowledge, the subject of our biographical sketch should feel envious of the good fortune of the students whom from day to day he saw walking with book in hand around the pleasant wood-shaded paths of the College grounds, and he yearned for the means, which seemed so far out of his reach, for obtaining better education, the want of which he felt he so much needed. The thoughts that these collegians could have access to a library of rich and interesting information which he seemed debarred from ever reaching, galled the boy's spirit. If he even could have access to a single work on mechanics it would have been to him a treasure. Unfortunately his parents and friends were all poor, and the boy's wages barely sufficed to pay his board and clothe him.

Fortunately this thirst for knowledge was by the kindness of the Principal of the College soon to be assuaged, for observing the mechanical talent of the youth, and appreciating his self-denial and the sacrifices he was making to improve his mind, he, one day, to the boy's great delight, sent to him a notification that he could enter as a student in the Normal School of the College.

Here was an unexpected happiness. He was 19 years of age, fast growing into manhood, and now at the last moment he happily found the door open to him for advancement. He was now in a position to study without the necessity of resorting to his trade to pay for his board. The avidity with which he applied himself to his studies, and the rapid progress that he made in the exact sciences astonished his teachers. In this school he remained until he had passed through the whole of the regular courses.

On leaving this institution the first question he had to consider was what should be his future pursuit in life.

Many young men in his position, particularly after receiving an education qualifying them for a higher sphere, would have felt it hurtful to their feelings to resume the humble mechanical trade of a shoemaker as carried on in those days. But Louis Côté had no such false pride. In his school days a certain idea had become fixed in his mind—a sort of dream of life—that he would become the head of a large industrial establishment, and bring into play those brain thoughts that as yet were but ideal imaginations, but for which he was prepared to make any sacrifice to put into some tangible form.

To attain this end he did not fail to take advantage of

MR. LOUIS COTE.

every occasion to increase his store of knowledge and experience.

With these views firmly resolved upon, he entered at once into the establishment of Messrs. Smith & Corcoran, boot and shoe manufacturers, where he resumed his trade and soon worked himself into a good position. All day long he worked with ardour, and when the day's work was over, instead of amusing himself as many young men in his position would do, by frivolity, he went to a night-school for still further instruction in that which he considered he was deficient.

In 1863, the firm above mentioned left St. Hyacinthe, and with the fruits of their economy and labor they founded at Quebec an industry which to-day affords support to a considerable portion of the population of St. Roch and St. Sauveur.

The ambition, however, of Mr. Côté was to establish in St. Hyacinthe, where he had met such kind friends, a shoe factory. He therefore returned to that town after a short absence, and there, in partnership with his brother George, he founded the first shoe factory in that town. Here then, at last, he found himself in a position to put into form the dreams of his youth, and to develope his inventive genius. As a consequence, his labor-saving improvements in shoe machinery soon brought prosperity to the business. Very soon the machines he invented produced a revolution in the shoemaking establishments both in Canada and the United States. And thus Louis Côté, the little shoemaker of St. Dominique, became the inventive genius of the French Canadian race, and produced machinery which our neighbours across the border, with all their gifts for invention, had failed to discover. It seemed to them hardly creditable that a Canadian should beat them in a field and in branches of trade in which heretofore they had considered themselves invincible.

We regret that our limited space will not allow us to enter into a description of these inventions of Mr. Côté's, but which may, some future day, form the subject of an article on Canadian inventions.

We trust that this short sketch of our countryman, still in the very prime of life, and enjoying a rich return for his inventive genius and business ability, will be an incentive to Canadians to seek to improve their minds by study and steady application to business, and, although every one is not gifted by nature with certain talents or ability, yet nothing is more certain than that he who studiously, when young, applies himself to improve his mind, and cultivate whatever talent nature may have gifted him with, must in the end reap a reward.

Astronomy and Geology.

IS THE MOON INHABITED?

(From the English Mechanic.)

The writer of these remarks has repeatedly had the above question put to him. In return he would put the following:— What evidence have we of the habitability of the moon? Some writers have indulged in the speculation that, with the large telescopes now in existence, armies of soldiers, troops of elephants and such like may be detected on the march, and others have surmised that buildings might be seen and the styles of architecture ascertained. The ideas such extraordinary statements may induce in the minds of the uneducated render it desirable to examine a little into the probability of obtaining such results. The diameter of the moon is 2,163 miles; but, as it never remains at the same distance from the earth, being sometimes nearer and sometimes farther, it never presents the same apparent diameter as seen in the sky. When nearest the earth it is seen under the largest angle, or 33' 33"·20; but when farthest from the earth it is seen under the smallest angle, or 29' 23"·65. Now it follows from the relation between the real and apparent diameters of the moon, at its mean distance from the earth, that a second of arc, written thus (1"), is the angle under which a mile and a little more than the tenth of a mile, written thus 1·139, is seen at the centre of the moon's disc; again, as a second is pretty well the smallest distance that can be clearly discerned, it follows that a building on the moon to be clearly seen—we may say to be seen at all, must be about a square mile in extent, and then it would be seen only as a spot, light or dark according as the materials of which it was built reflected a larger or smaller quantity of light.

There are some very level plains on the surface of the moon, surrounded by mountains. One such plain has been very carefully examined; it is about sixty miles in diameter. The mountain wall rises to a height of 3,000 feet on the south, 3,200 on the west and north, and 3,800 on the east. On the wall are four lofty pinnacles of rock, three on the west and one on the east. The highest, which is on the east, rises to the height of 7,418 feet above the level interior; the next highest is on the west; its altitude is 7,258 feet; the two lower rocks are respectively 6,396 and 5,128 feet above the interior.

Let us place ourselves, in imagination, within the confines of this mountain-cinctured plain, and view from its centre its girdling rocks at a distance of 30 miles; they would appear from this point under a vertical angle of very little more than one degree, and the highest rock on the east would subtend an angle of less than three. It is believed that no other portion of the moon has undergone so close a scrutiny as this. For three years has its surface or floor been examined, during sunshine upon it, with telescopes able to bring small objects into view, and the results carefully discussed, from which it appears that nowhere on this plain has anything at all approaching the nature of a building or a collection of buildings been detected. At various intervals, as many as thirty-six small white spots have been seen during the three years, but never the whole together. Ten of these spots have been ascertained to consist of volcanic cones, the bases having an average diameter of about one mile; the base of the largest, near the centre of the plain, certainly does not exceed two miles. With the exception of these natural productions nothing sufficiently elevated above the surface to cast a shadow at sunrise or sunset exists on this plain; there are, indeed, some remarkable variations of brightness upon it: for example, about the middle of the day, when the sun is highest, it appears very dark, almost black, but there is nothing to induce the opinion that a patch of a different tint exists anywhere on this plain, such as might be supposed to arise from a collection of buildings covering a space of four or five miles in extent. From such facts as these, the results of close and unremitting observation, into which conjecture is not permitted to enter, we are forced to the conclusion that the evidence we possess of the habitability of the moon is very scanty. Indeed, it does not even furnish a clue by which we might institute a series of observations likely to lead to a positive result.

It must, however, be remembered that the walled plain, Plato, to which the foregoing remarks refer, is but a very small part of the moon's surface, and it would be manifestly unsafe to draw any conclusions on the above question from the examination of so small a part, carefully as that part has been examined. While there may be great difficulty in detecting any evidence of artificial construction, it is beginning to be ascertained that there is not so much difficulty as formerly in detecting instances of physical change. The discovery in May, 1877, by Dr. Klein, of a dark spot north-west of Hyginus, where nothing of the kind had been seen before, combined with the celebrated case of Linné, will go far to show that changes of a physical character and of sufficient magnitude to be seen from the earth are now in operation, and will doubtless open up a line of research by which we may learn something of the nature of the forces at work within the moon, and form more accurate notions of our satellite than those to which we have been treated of late years, such as a "burnt-up cinder," "a dead world," or one reduced to its last stage of existence. So far as we are able to judge of the mundane processes going on around us, there is a perpetual cycle of recurring physical events by which decay is replaced by renovation. We have, on our own globe, instances of very ancient formations and others of a most recent date: the same alternation of ancient and recent tracts are found on the moon, and it would not be difficult from careful observation to assign the epochs of some of the most striking series of changes. Indeed, a chronological arrangement of the large grey plains, of the craters in their neighbourhoods previously existing, and of those opened upon their surfaces, has been attempted upon a large scale, but it is evident that the study of the more minute objects is likely to be attended with results upon which a more correct system of lunar topography can be raised, which, in its turn, will conduct the student to a satisfactory system of selenology.

TYNDALL'S NEW VIEWS.

Professor Tyndall's latest thesis is: That it is as difficult to conceive the government of matter by the operation of spirit—as in lifting the arm by the power of the will for example—as it is difficult to conceive of the origination of life by the action or revolution of matter—no distinction, apparently, being drawn between vegetable life and soul or spirit. Well, suppose we can conceive neither process in our finite and imperfect minds—still we can appeal to facts and the visible order of things, to show that the one statement is true and the other certainly false as regards spirit. If our Saviour says, "My words are Spirit, and they are Life," and we find in practice, and by witnessing the creative power of those words, both in the world of spirit and in that of matter, that what He has asserted is true—it is of minor consequence how far we can follow the operation in our own minds. We have the general results, the fact or congeries of facts, and such will be enough for us, for we are thus convinced that spirit governs matter. Matter is certainly seen to obstruct the operations of spirit, but it does so without a particle of evidence that its action arises from the force of a living will contained in itself. In so plain a case and where we have such broad facts at our service, why fret about speculative wants? We have discovered that the government of matter by spirit is the unfailing principle of the world we inhabit. The apparent limitations do not contradict the rule.

On the other limit of his thesis, Mr. Tyndall cannot in the face of facts contend that the operation of spirit and truth enunciated by words is the work of matter, any more than that it is the original work of the human soul, when it is found so constantly to traverse the movements of that soul.

But the world is habituated and rehabituated by these words and that which actuates them, and that entity is spirit, which we often find in a lesser or greater degree influencing kings and governors, ministers and subjects, but which we behold in manifested strength, disengaging itself from decaying or dissolving matter in the death bed of many a Christian. These are but facts in human history, and the facts he ought to lay hold of. He will say that man becomes grand by evolution, but history tells us that no people ever became great, or even achieved the beginnings of greatness, without the idea of God, which is not the fruit of evolution.

Thus we hear the sound of the spirit, and behold its living fruits on all hands, but we know not, any further than we have been told, whence it cometh or whither it goeth. HOMO.

ENORMOUS SUBMARINE PLANT.—Explorers have recently reported the discovery of an enormous submarine plant in the North Pacific ocean. It is known to botanists as the *Macrocistis pyritera*, is said to dwarf all vegetable products yet known by its prodigious proportions. It grows sometimes to such a size as to cover vast areas of sea-bed, one specimen having been discovered that occupied by measurement three square miles, while the stem was eight feet thick.

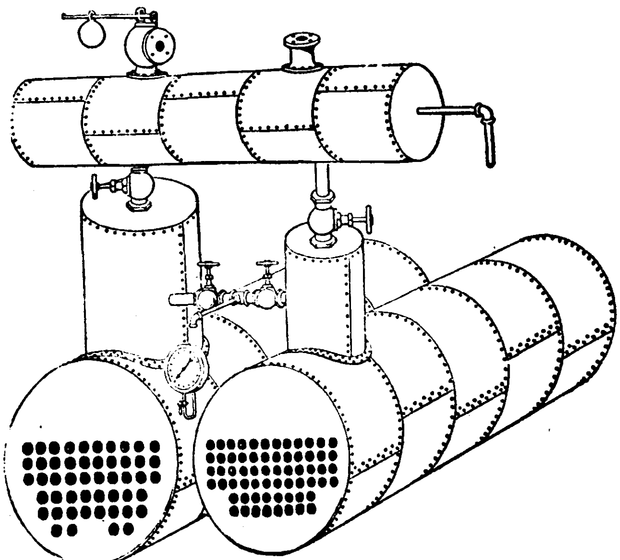


Fig. 1.

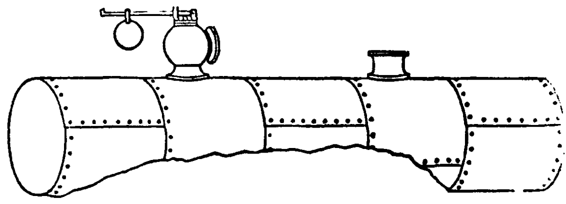


Fig. 2.

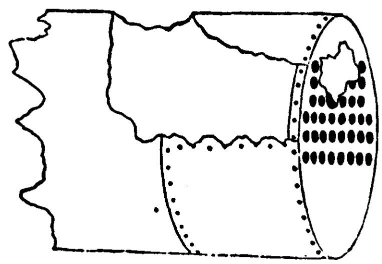
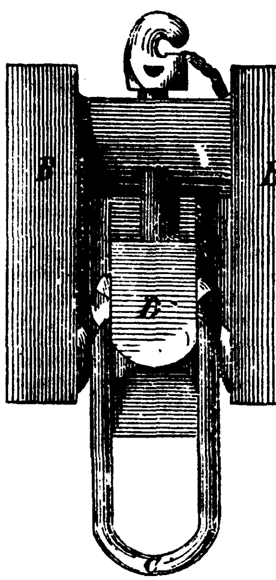


Fig. 3.

FIG. 3.



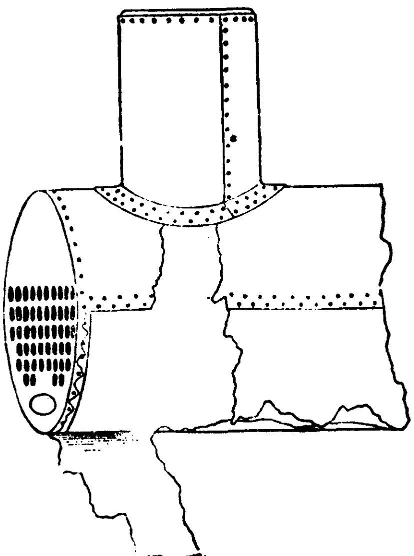


Fig. 4.

DANGEROUS METHOD OF CONNECTING STEAMBOILERS.

The Hartford Steam-Boiler Inspection and Insurance Co., of Hartford, Conn., in their official report, note a very dangerous method of setting and connecting boilers where two boilers are provided with only one safety valve, and yet each boiler is provided with a "stop-valve," that is, valves so situated that either boiler can be shut off when not in use. The danger here is that when the idle boiler is put into use the attendant will forget or neglect to open the stop-valve, and, there being no outlet to the *one* safety-valve, the pressure increases until the surrounding metal is unable to resist the internal pressure and an explosion occurs. Boilers should in no case be set in this way unless each boiler is provided with its own safety-valve located on the shell of the boiler. We have known of several very serious accidents arising from this style of fitting. A case occurred during the past year. The owners of the boilers were substantial men, and had no idea of the responsibility they incurred. Their attention was called to the danger, and they evidently intended to give it early attention, but failed to do so, and a serious disaster followed.

Fig. 1 shows the original condition of the boilers, with steam-drum on top. It appears that for some reason one boiler had been shut off, and the steam-gauge boilers had been removed for repairs. The boiler was fired up, and a destructive explosion occurred. Fortunately no lives were lost. There are many boilers through the country set in this way, and serious accidents have occurred and will occur so long as this practice is followed.

Portions of the boiler were thrown from 300 to 700 feet. The adjoining engravings will show the manner in which the iron was torn. Fig. 2 represents the top of the drum after it was torn off from the lower portion. Fig. 3 is the rear end of the left-hand boiler; it was thrown a distance of 225 feet; while Fig. 4 shows the front end of the same boiler, which remained in its place but was badly torn up.

Fine Arts. EXAMPLES OF ANCIENT POTTERY.—*(Continued from page 6.)*

DANGER FROM THIN ICE.

[For the SCIENTIFIC CANADIAN.]

The use of ropes for drawing across the surface of the ice the person who has been delivered from the first danger by immersion by the agency of the ice-pole was omitted to be mentioned in the article in last month's issue of the SCIENTIFIC CANADIAN.

Their value is so obvious that it will doubtless have suggested itself to many readers. Let it suffice to say here, that the Humane Society men, in their winter as well as summer service, are always provided with ropes of the proper stoutness, and make frequent use of them in their numerous successful rescues. Joe Vincent would be the man, I think, to organize a corpse of life-savers.

HOMO.

A FAST FIRE ENGINE.—Switzerland exhibited at Paris a self-propelling fire-engine, which traveled to the Exhibition, a distance of 250 miles, in eighteen hours. This was a very good performance, being over 14 miles an hour.

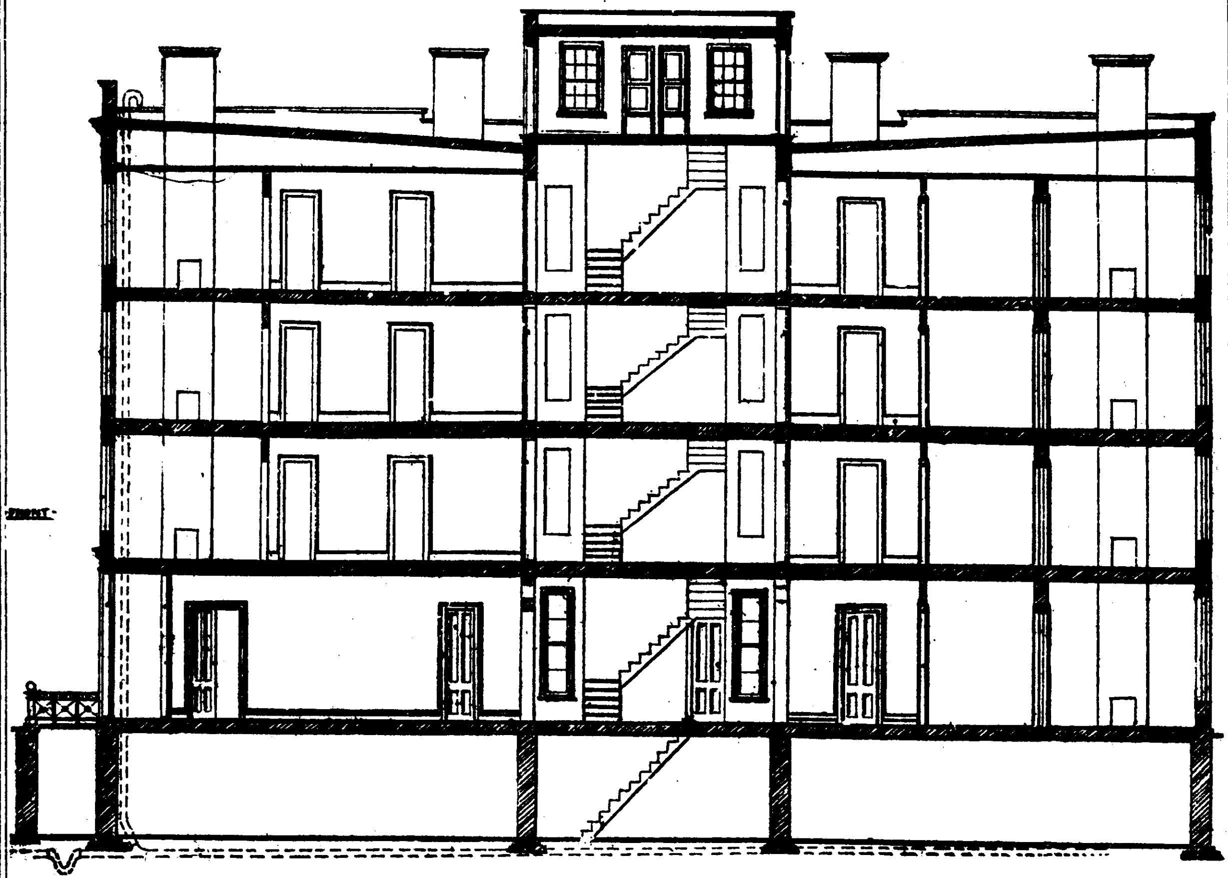
MODEL TENEMENT HOUSES.

We give an illustration of the design for a model tenement house to be erected in New York, and for which the first prize was awarded. The enterprise was set on foot by that enterprising journal, *The Plumber*—whose excellent sanitary remarks we are often indebted to for much information—and certain gentlemen of New York. The interest aroused by the competition of designs bears witness, not only to the judgment of the projectors, but to the importance of the subject and the attention it is receiving from many classes of persons. We, in fact, quote the remarks of the *American Architect*, one of the best authorities on the subject. Nearly 200 designs were sent in, ranging from London to San Francisco.

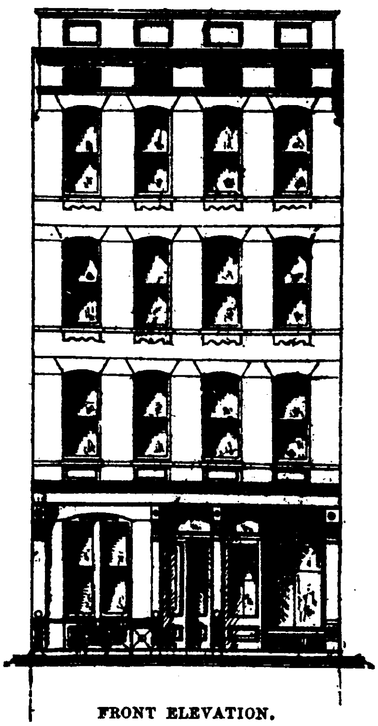
The *American Architect*, in alluding to the subject, remarks :—

" The conditions of the problem were made, designedly perhaps, the most unpromising possible ; the building on all sides being required to fit a New York city lot of twenty-five by one hundred feet, surrounded by other

MODEL TENEMENT HOUSE.—First Prize Design, James E. Ware, Architect, New York.



LONGITUDINAL SECTION.



FRONT ELEVATION.

buildings on all sides but the narrow street in front. It was to be of brick, with wooden floors and a fire-proof stairway."

REPORT OF THE COMMITTEE.

(From "The Plumber and Sanitary Engineer.")

In submitting the results of their examination of the designs of Model Houses for Workingmen, received in the competition instituted by your journal, the undersigned would express their satisfaction at the number and variety of the plans sent in. No less than 190 separate designs were received from above thirty different localities, including all the leading cities of the United States, besides several others in Canada, and one from London, England.

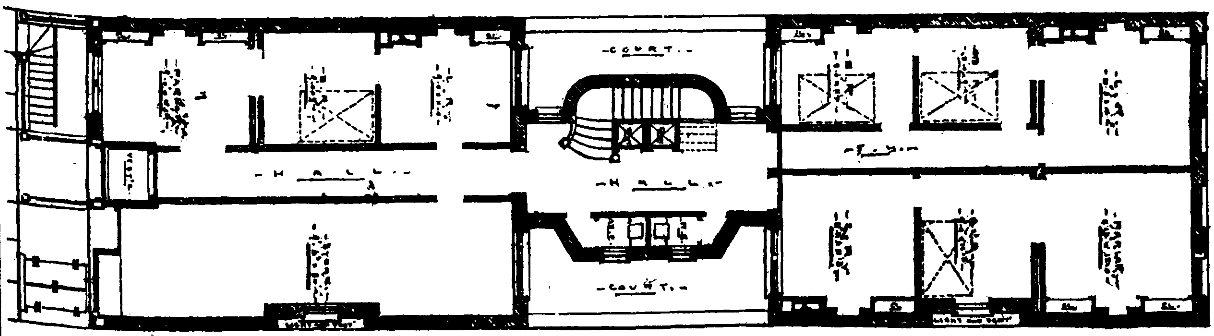
The object of the competition, as stated at the time it was instituted, was to obtain, if possible, designs for

"A house for workingmen, in which may be secured a proper distribution of light and pure air, with an arrangement of rooms that will yield a rental sufficient to pay a fair interest on the investment; and that as a result the single lot owner, as well as the capitalist, may be shown how they can benefit those who are forced to live in tenements, and, at the same time, secure a paying investment."

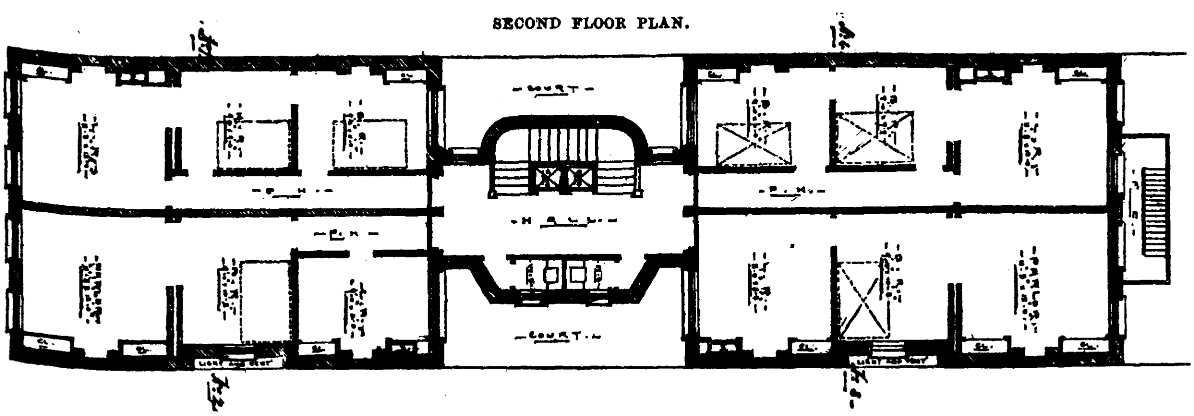
These considerations had due weight with your Committee, and their awards are limited to plans for dwellings which will pay a fair profit to their owners.

Many of the designs submitted, while admirable in most respects, failed to fulfil this condition, and were consequently rejected. On this account plans for houses accommodating but one or two families on each floor were not considered, while other plans with narrow side courts, which if built in couples might be satisfactory, were rejected, for the reason that the competition is limited to plans for a *single house*.

FIRST FLOOR PLAN.



SECOND FLOOR PLAN.



NOTE.—Living rooms are designated by L. R.
Bed rooms " B. R.
Closets " C.
Private halls " P. H.

Dumb waiters are designated by D. W.
Water closets " W. C.
Fire escape " F. E.
Sinks " S.

The object of the competition was to demonstrate if it is possible to build a model house for workingmen on the existing city lot, 25x100, and while the plans selected for approval come nearest to fulfilling the terms of the competition, the committee emphatically declare that in their view it is impossible to secure the requirements of physical and moral health within these narrow and arbitrary limits.

Nevertheless your committee is free to say that many of the plans are an improvement on the existing tenement houses of New York, not excluding in this comparison those most recently built.

To secure a proper reform in our tenement house system, laws must be carefully enacted and strictly enforced regulating the number of occupants, the amount of open space, the provisions for light, ventilation and cleanliness, on sound sanitary principles; there would then result a gradual re-distribution of our city population which would end in leaving the income of real estate owners relatively as great as before.

Your Committee therefore recommend further agitation to obtain needed legislation, and believe that another public meeting will tend to this end.

The following plans have been selected by the Committee in accordance with the Terms of the Competition :—

No. 1.—"LIGHT, AIR AND HEALTH, C," Prize, $250 : JAMES E. WARE, No. 697 Broadway, New York.

No. 2.—"KENSINGTON," Prize, $125 : HENRY PALMER, 56 Wall Street, New York.

No. 3.—"UT PROSIM," Prize, $75 : D. & J. JARDINE, 1,267 Broadway, New York.

No. 4.—"PETER COOPER," Prize, $50 : WILLIAM KUHLES, No. 111 Broadway, N. Y.

No. 5.—"YOUR KIND CONSIDERATION," L. CASS MILLER, No. 17 Park Row, N. Y.

No. 6.—"PATENT," GEO. W. DA CUNHA, 207 W. 38th Street, New York.

No. 7.—"DOMESTICUS," HENRY F. KILBURN, 229 Broadway, New York.

No. 8.—"SANITAS, No. 2," R. G. KENNEDY, 735 Walnut Street, Philadelphia.

No. 9.—"LIGHT, AIR AND HEALTH, D," JAMES E. WARE, No. 697 Broadway, New York.

No. 10.—"POCO TIEMPO," CHARLES J. FURST, 106 Fifth Ave., Chicago.

No. 11.—"COMFORT," C. F. ROSE, Poughkeepsie.

No. 12.—A Maltese Cross in a Quatrefoil, J. H. BESARICK, 32 Pemberton Square, Boston.

CHAS. F. CHANDLER,
JOHN HALL,
HENRY C. POTTER,
ROBERT HOE,
JAMES RENWICK,
} *Committee of Award.*

MINUTE.

The Committee of Award, on assembling for the duty assigned to it, finds itself deprived by death of the most valuable services of its Chairman, R. G. Hatfield, Esq. The Committee desires to put upon record the expression of its unfeigned sorrow in losing thus the guidance and counsel of one on whom it would naturally have chiefly leaned. Mr. Hatfield's interest in the work assigned to the Committee was evinced from the beginning, in the most self-sacrificing way, and his notes are among the most valuable helps which the Committee has had in reaching its conclusions.

The loss which the Committee on Awards has sustained in Mr. Hatfield's death indicates, in some measure, the loss which has been sustained by the community at large. Mr. Hatfield's blameless and upright character, his long and honourable career as a citizen and in his profession, his fidelity to every duty and in every trust, made him widely known and esteemed, and in his death the community generally loses one of its most valued members.

The Committee instructs its Secretary to place a copy of the foregoing minute upon its records, and to communicate a copy to the family of its late associate.

[Signed] H. C. POTTER,
R. HOE,
} *Special Committee.*

Horology and Goldsmith's Work.

FORMULAS AND PROCESSES.

(*Continued from page 54.*)

DRY COLORED GOLD ALLOYS.—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.

ALLOY FOR DRY-COLORED RINGS. 17 K. — Gold 1 oz.; silver 4 dwts., 6 grs.; copper 4 dwts., 6 grs.

SOLDER FOR THE ABOVE. — Scrap gold 2 oz.; silver 3 dwts.; copper 3 dwts.

OF DRY COLORING THE FOREGOING ALLOYS.—This is done as follows: Having your work well polished, take of saltpetre, alum, and salt in proportion to the work to be colored; say, for 2 oz. of work, as under, viz.:—Saltpetre, 8 oz.; alum, 4 oz.; salt, 4 oz. Procure also a blacklead pot, four or five inches high, or an iron pot cast from a blacklead pot; one or two sizes will be useful. To perform the process of dry-coloring, you must have a thin iron bar to stir your "color" when dissolving. Your work cannot be too well polished; it is then cleaned with soda, soap, and hot water, and dried in box sawdust. It must be afterward covered with a thin layer of borax; annealed and boiled out, and again dried in box sawdust; and finally hung on platinum, or fine silver wire. When the "color" is in the pot, it is placed in the fire on a forge, and blown with bellows; it soon boils up. The heat cannot be too strong. When it assumes a brown-yellow flame, the work is dipped in for two or three seconds, and quenched in hot water diluted with muriatic acid, which removes any "color" that may adhere to the work. This ought to produce the color required; if it does not come, the same process must be followed again; but the work must be well dried before going into the "color," otherwise it will fly about, the burn or scald from which is very severe. Indeed, it is recommended to wear an old glove to save the hand. The color-pot must be emptied immediately upon the forge, so that it may be ready if required again. In this process of coloring it is necessary to be very quick, whereas in wet-coloring it takes time. The waste "color" may be thrown into the sweep, as the gold lost is trifling.

WET COLORED GOLD ALLOYS.— No. 1. 15 k. — Gold 1 oz.; silver 3 dwts., 12 grs.; copper 9 dwts.

No. 2. 14 k. — Gold 1 oz.; silver 4 dwts.; copper 9 dwts., 12 grs.

No. 3. 14 k. — Gold 1 oz.; silver 4 dwts., 12 grs.; copper 10 dwts.

No. 4. 13 k. —Gold 1 oz.; silver 4 dwts., 12 grs.; copper 10 dwts., 12 grs.

GREEN GOLD FOR FANCY WORK. — No. 5. 18 k. — Gold 1 oz.; silver 6 dwts., 16 grs.

GREEN GOLD.— No. 6. 20 k.— Gold 10 dwts.; silver 2 dwts., 2 grs.

GREEN GOLD.— No. 7. 19 k.— Gold 5 dwts.; silver 1 dwt., 12 grs.

RED GOLD, FOR FANCY WORK.—No. 8. 16 k.—Gold 5 dwts.; copper 2 dwts., 12 grs.

RED GOLD. —No. 9. 19 k. (20 k, so called)— Gold 5 dwts.; copper 1 dwt., 6 grs.

To make gold solder for the foregoing alloys, take of the alloyed gold you are using, 1 dwt.; silver 6 grs. Or, 5 grs. of silver and 1 gr. of copper may be used.

ANOTHER SOLDER. — Gold alloyed 1 dwt.; silver 5 grs.; pin-brass 1 gr.

This solder is good for repairing, and will not disturb the solder first mentioned. It will color well.

ALLOY.—No. 10. 15 k.—Gold 1 oz., 18 dwts.; silver 12 dwts., 12 grs.; copper 10 dwts.

No. 11. 14 k.—Gold 1 oz.; silver 8 dwts.; copper 4 dwts.

No. 12. 13 k.—Gold 1 oz.; silver 6 dwts.; copper 8 dwts.

No. 13. 13 k.—Gold 1 oz.; silver 4 dwts., 12 grs.; copper 10 dwts., 12 grs. This is usually employed by the London jewelers for their 14 k. work.

VERY FINE COLOR.—No. 14. 16 k.—Gold 1 oz.; silver 6 dwts.; copper 4 dwts.

GOLD SOLDER FOR THE ABOVE. — Gold scrap 1 oz.; silver 5 dwts.

METHOD OF REDUCING ENGLISH SOVEREIGNS TO LOWER FINENESS.—No. 1. 14 k.—Coins 1 oz.; gold 8 oz.; silver 2 oz.; copper 4 oz., 14 dwts.

No. 2. 14 k.—Coins 1 oz.; gold 2 oz.; silver 13 dwts.; copper 1 oz., 11 dwts.

No. 3. 14 k.—Coins 2 oz.; gold 5 oz.; silver 1 oz., 9 dwts., 12 grs.; copper 11 dwts., 12 grs.

No. 4. 15 k.— Coins 2 oz.; gold 6 oz.; silver 1 oz., 14 dwts.; copper 4 oz., 2 dwts.

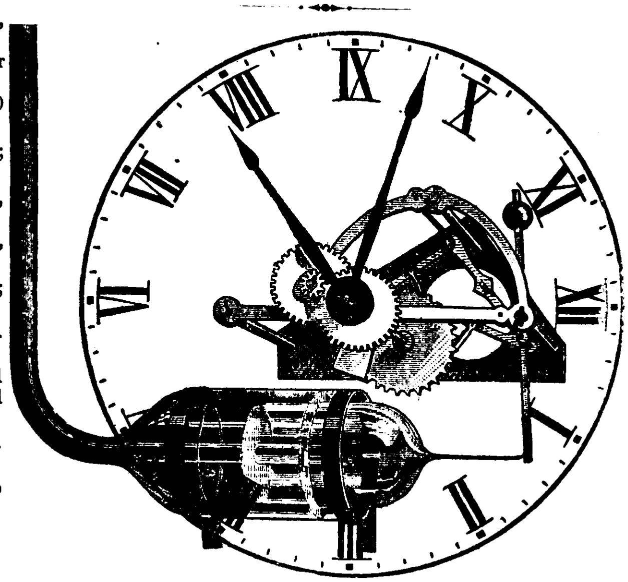
No. 5. 15 k.—Coins 2 oz.; gold 8 oz.; silver 2 oz., 3 dwts.; copper 5 oz., 3 dwts.

No. 6. 15 k.—Coins 4 oz.; gold 6 oz.; silver 2 oz., 2 dwts.; copper 5 oz., 2 dwts.

LONDON METHOD OF WET-COLORING THE FOREGOING ALLOYS. —This is performed in the following manner: Having annealed your work, and boiled it out so as to get it perfectly clean, take of saltpetre 15 oz., of alum, 7 oz. and of salt 7 oz.; pound them all fine, and mix well together; then provide a black-lead pot about 12 inches high, put your ingredients into it, and dissolve gradually. It must be on no account hurried, for if it burns, the "color" will be spoiled. As the heat increases it will boil up; then add 2 oz. of muriatic acid, when the "color" will sink in the pot. Take a wooden spoon and stir it well, when it will again boil up. Take your work, which you have made clean and tied in small parcels with platinum or fine silver wire, and immerse it in the "color" for four minutes, keeping it on the move, so that the "color" may act upon all parts alike. At the end of that time take it out and rinse it well in boiling water, which you have ready in a kettle, with pint or quart basins, according to the quantity or size of your work. Next, place your work in the "color" for one minute and a-half; take it out and rinse well in fresh hot water. Two fluid oz. of hot water must then be added, when the "color" will sink in the pot, but will rise again; put in your work for one minute, again rinsing it in fresh hot water, when you will find it begin to brighten. Lastly, put your work in the "color" for half a minute longer, rinsing it for the last time in clean hot water, after which you will find it a beautiful color. This process, by a little attention, never fails.

NOTE.—The mixture of "coloring" should be according to the weight of work. If a small quantity, say 2 oz., the proportions should be: Saltpetre 8 oz., alum 4 oz., common salt 4 oz., muriatic acid 1 oz. If 5 oz. of work, double the quantities, and so in proportion to the weight; but practice will make perfect.

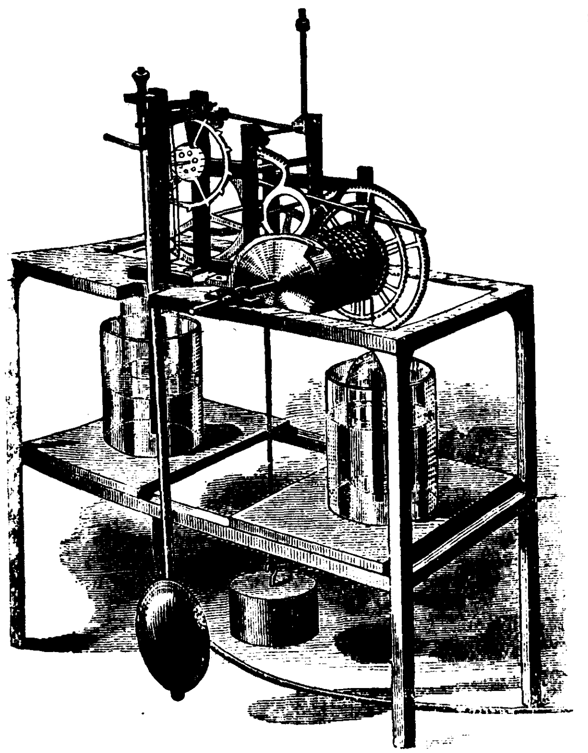
(*To be continued.*)



PNEUMATIC REGULATOR FOR CLOCKS.

The pneumatic clock regulator represented by the accompanying engravings, is the invention of Mr. E. J. Muybridge, of San Francisco. It is intended to regulate with accuracy a certain number of clocks located in different parts of large cities.

The pneumatic regulator may be applied to any ordinary clock operated by weights, springs, or other motive power. It consists of a series of hollow bells, plunging into and emerging alternately from vessels filled with a liquid; by this means the air within the bells is compressed and forced through tubes into a second vessel filled with the same liquid, where the tubes end just below a second series of bells corresponding in number to the clocks to be regulated. From here the air acts directly on the gearing of the second and minute hands of the clocks. The



further details are easily understood from the engravings. Fig. 1 represents the clock combined with the regulator, which acts on the clock, represented by Fig. 2, which may be situated at any distant point.

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

Cabinet Makers' and Carvers' Receipts.

To Transfer Engravings from Paper to Wood. — The following is an extract from an article entitled "Pictures and Devices upon Wood," in an old number of the *Penny Magazine*:—"First prepare carefully a panel of sycamore, horse-chestnut, satinwood, maple, or other kind of wood. When the surface is perfectly smooth, it is coated with a layer of hot glue, which when dry is rubbed with glass paper to render the surface uniform. It is then successively coated with spirit varnish five or six times, each coat being dry before the next is applied. The print is laid on a smooth table, face downwards, the back is moistened with water, the surplus water being removed by two sheets of blotting-paper, between which the print is placed; while the print is moist another layer of varnish is applied to the wood, the print is immediately laid on, its face downwards, and carefully pressed. It is then left until dry; when dry the back of the print is moistened, and the fingers are rubbed slightly backwards and forwards till the paper comes off in small rolled fragments. When dry, another coating of varnish is laid on, and the surface polished with Dutch-rush steeped three or four days in olive oil, the oil is wiped off with a soft cloth, and any remaining portion is absorbed by a little powdered starch carefully wiped off afterwards. Three or four layers of varnish are then applied, and the surface is lastly polished with a fine woollen cloth dipped in a little powdered whiting or chalk; the print or impression then presents itself as if on the surface of the wood."

Dyed Veneers.—Some German cabinet makers, after numerous experiments, have perfected a process for dying veneers through and through. The veneers are first soaked for twenty-four hours in a solution of caustic soda, and then boiled therein for half an hour. They are then washed with water until all the alkali has been removed, when they are ready to receive the dye. This treatment with soda effects a general disintegration of the wood, whereby it becomes, in the moist state, elastic and leather-like, and prepared to absorb the colour. Veneers thus treated, if left for twenty-four hours in a hot decoction of logwood, and, after superficial dying, immersed for twenty-four hours more in a hot solution of copperas, becomes of a beautiful and permanent black throughout. A solution of picric acid in water, with the addition of ammonia, gives a yellow color, not in the least affected by subsequent varnishing. Coralline dissolved in hot water, to which a little caustic soda and one-fifth its volume of soluble glass have been added, produce the color of different shades, dependent on the amount of coralline taken. After dyeing, they are dried between sheets of paper and subjected to pressure to retain their shape.

French Varnish for Cabinet Work.—Take of shellac 1½ ozs.; gum mastic and gum sandarac, of each ½ oz., spirit of wine by weight 20 ozs. The gums to be first dissolved in the spirit, and lastly the shellac. This may be best effected by means of the water bath. Place a loosely corked bottle containing the mixture in a vessel of warm water of a temperature below the boiling point, and let it remain until the gums are dissolved. Should evaporation take place, an equal quantity to the spirit of wine so lost must be replaced till the mixture settles, then pour off the clear liquid for use, leaving the impurities behind; but do not filter it. Greater hardness may be given to the varnish by increasing the quantity of shellac, which may be done to the amount of one-twelfth of the lac to eleven-twelfths of the spirit. But in this latter proportion the varnish loses its transparency in some degree, and must be laid on in very small quantities at a time.

Polishing Fretwork. — First sand-paper the wood with coarse sand-paper and fine glass-paper, taking care not to rub across the grain. When the wood is perfectly smooth and free from flaws, it should be well oiled, by taking a piece of cotton wool and folding it upon a piece of linen, which should be dipped in oil, and then rubbed well into the wood. This should be done several times, and allowed to dry. Another wad should then be made, and the cotton wool inside it dipped in French polish (to be had at any Italian warehouse) and well rubbed in; the hand in rubbing it should be moved in circles, and not up and down the grain; directly the wad feels sticking on the wood, the oil wad should be slightly rubbed over the place and then allowed to dry; and then, when dry, begin again with the polish. When a good polish has been obtained on the wood, spirits of wine should be rubbed in to prevent its losing its brilliancy.—*Cabinet Maker*.

To Cut Steel Plate for Scrapers.—Every workman knows that part of the blade of a broken saw is the best scraper he can use; but as it is very hard, it is difficult to be cut into the form required for a scraper. As it is very tedious to cut it with a file, the best, and at the same time the most expeditious, is to mark out the size you wish, and place the piece of the blade or steel plate in a vise whose chaps shut very close, placing the mark even with the face of the vise, and the part of the plate that is to be cut to waste above the vise. Then with a cold chisel or a common steel firmer that has its basil broken off, holding it close to the vise and rather inclined upwards, begin at one end of the steel plate, and with a sharp blow of the hammer it will cut it; keep going on by degrees, and you will, with a great deal of ease, cut it to the shape required. You have only then to grind the edges of your scraper level, and rub it afterwards on your Turkey stone, and it is complete.

A Very Simple Pantagraph.—Schnaus suggests the use of a fine rubber cord, about 15 inches long, supplied with a loop at each end, and having on it a small white bead, sliding upon it with gentle friction. By securing one end to the table by a pin, and passing a pencil through the other end, and drawing its point over the paper with the right hand, keeping the string stretched, and causing the bead to describe the outline of a simple drawing placed beneath it, a tolerably good copy of the drawing will be produced, bearing any desired proportion to the original, according to the position given to the bead on the string; thus, if the bead is in the centre of the cord, the drawing will be double the size of the original. The best results are only obtainable after some practice, and by employing a finer point than a bead.

EBONY.—Of this wood there are several varieties in the market, the only one serviceable to the carver being one with a close and even grain, so close, indeed, that under the gouge it appears to have no fibre whatever. The hardness renders it extremely difficult to work, and for this reason ebony carvings are of great value. The great defect which this wood has, is its tendency to exfoliate, and to split. An imitation ebony is sometimes offered, which is made by soaking pear-wood in an iron and tanning dye-beck for a week or more. The colour penetrates to the very heart of the wood, so that the cut is as black as ebony.—*English Mechanic.*

PROTECTION OF WOOD CARVINGS.—Worm-eaten wood may be saved from further ravages by fumigating it with benzine, whereby the worm is destroyed. Another way is to saturate the wood with a strong solution of corrosive sublimate—a process which may be advantageously employed to protect carvings in wood. But as sublimate destroys its color, it will be necessary to restore the latter by ammonia, and then by a very dilute solution of hydrochloric acid. The holes made by the worm may then be injected with gum and gelatine; and a varnish of resin, dissolved in spirits of wine, should afterwards be applied to the surface.

A SATINWOOD STAIN FOR THE INSIDE OF DRAWERS.—Take 1 quart of alcohol, 3 ozs. of ground turmeric, 1½ ozs. of powdered gamboge. When this mixture has been steeped to its full strength, strain through fine muslin. It is then ready for use. Apply with a piece of fine sponge, giving the work two coats. When it is dry, sand-paper down very fine. It is then ready for varnish or French polish, and makes an excellent imitation of the most beautiful satinwood.

A CHEAP BLACK STAIN FOR PINE OR WHITEWOOD. — Take 1 gallon of water, 1 lb. of logwood chips, ½ lb. of black copperas, ½ lb. of extract of logwood, ½ lb. of indigo blue, and 2 ozs. of lampblack. Put these into an iron pot and boil them over a slow fire. When the mixture is cool, strain it through a cloth, and add ½ oz. of nut-gall. It is then ready for use. This is a very good black for all kinds of cheap work.

TO STAIN BOX-WOOD BROWN.—Hold your work to the fire that it may receive a gentle warmth, then take aquafortis, and with a feather or brush, pass over the work till you find it change to a fine brown (always keeping it near the fire); you may then oil and polish it.

A CRIMSON SPIRIT STAIN.—Take 1 quart of alcohol, 3 ozs. of Brazil-wood, ½ oz. of dragon's-blood, ½ oz. of cochineal, and 1 oz. of saffron. Steep to full strength and strain. It is a beautiful stain for violins and other wooden musical instruments, work-boxes, and fancy articles.

A POLISH FOR REMOVING STAINS, &C., FROM FURNITURE.—Take ½ pint of alcohol, ¼ oz. pulverized resin, ¼ oz. gum shellac, ½ pint boiled linseed oil. Shake the mixture well and apply with a sponge, brush, or cotton flannel, rubbing well after the application.

TRANSPARENT GUM.—A little glycerine added to gum or glue is a great improvement, as it prevents the gum or glue becoming brittle. It also prevents gummed labels from having a tendency to curl up when being written on.

PAINT STAINS ON GLASS. — American potash, 3 parts; unslaked lime, 1 part. Lay this on with a stick, letting it remain for some time, and it will remove either tar or paint.

CLEANING CARVED WOOD.—The feather end of an old quill pen will, by the aid of benzoline, effectually remove the dirt from the interstices of carvings.

ORNAMENTAL WORK ON ENGINES.—The movement to replace the brass ornamental work on engines with plain black finish has progressed very rapidly within a few years, effecting a saving which in the aggregate must be very considerable. It is true that an engine presenting to view an unrelieved black from pilot to tender does not have that splendor of appearance given by highly colored brass and brilliant gilding and striping, but it seems to draw just as well, and the road does not show any falling off of passengers or freight on account of the plainer finish.

NEW SYSTEM OF DRAW-BRIDGE.

The engraving on the opposite page we take from the *Manufacturer and Builder*. It represents another of the applications which may be made of the system of moving loads by simple hydraulic pressure, as invented by Mr. William Burdon, Brooklyn, N. Y.

The system here represented is especially intended for canals of limited width, and where it is desired not to encumber the shores or the approaches with machinery. The bridge is operated by simply turning a wheel, as seen at the right hand side of the engraving; this wheel admits water to a horizontal cylinder containing a piston, which, when the water is admitted, exerts a pull proportionately to its surface and the pressure of the head of water. In order not to oblige this pressure to lift more than the full weight of the draw, owing to the oblique direction of the pull, the following ingenious arrangement has been devised, by which not only the bridge is partly balanced, but the labor of the hydraulic lift is reduced to raising less than one-fourth of the weight of the bridge.

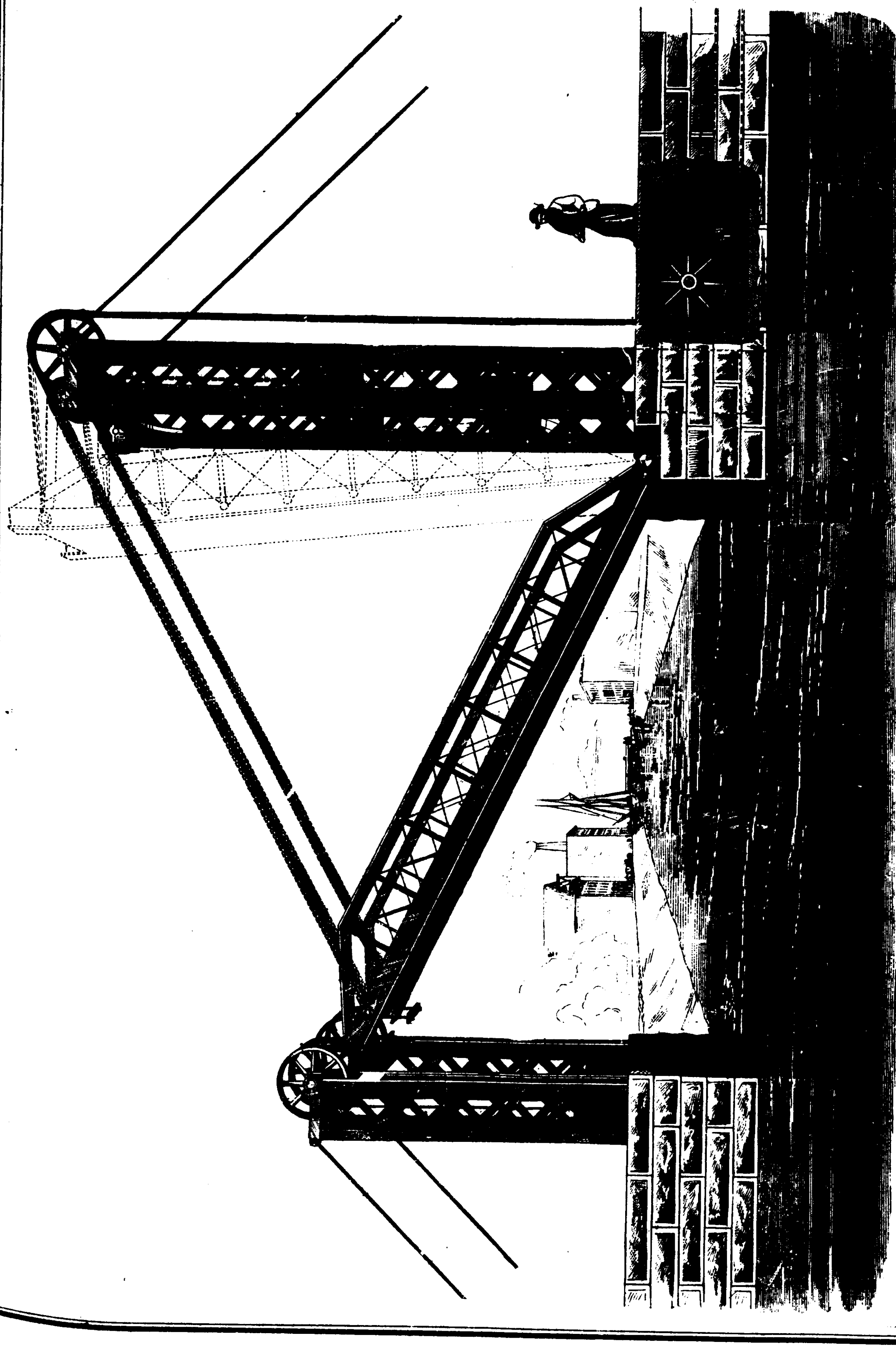
At the extremities of the piers wrought iron hollow columns are erected, in which weights to counterpoise the bridge move up and down. The peculiar arrangements of these weights is one of the special merits of Mr. Burdon's invention. The weights are suspended by chains, which run over pulleys at the top of the columns. The weights in the columns at the left, which are about 20 feet high, counterbalance ¼ of the bridge when it is in its horizontal position, when each pier carries half the weight of the bridge. The weights in the columns at the right side, of which there are two sets, counterbalance more than half the bridge, while the remaining quarter, which, however, by increasing the counterpoises, may be made considerably less than a quarter, is carried by the hydraulic lift. It is clear that as soon as the bridge is raised on one end the strain of the lift on the upper end becomes less, and that in the lower or pivoted end becomes greater, so that when it has attained an incline corresponding with an angle of about 40° with the horizon, it will only have to lift an amount of weight proportionate to the cosine of 40°, which is ¾; at this position the weights in the short left columns, which balance ¼ of the bridge, have reached the ground.

Our engraving represents the bridge in that position. Now the lower weights in the other right-hand columns, which balance another fourth part, assist in the further raising, until it has reached an angle of 60°. The cosine of this angle being ½ of the radius, it indicates that only ½ of the weight is left to be supported. The length of the chains supporting the lower weights in these long columns is so arranged that they then touch the ground. The upper weights still balance more than half of what there is left in the resistance, and they continue the work until the bridge has reached an angle of 75°, the cosine of which is ¼, which shows that only ¼ of the weight is to be lifted; at this point the last mentioned weights will in their turn touch the ground; and then at the last part of its course the hydraulic pressure, which thus was aided by the weights acting as a counterpoise, does the work alone, and brings the bridge in the erect position as indicated by the dotted lines in the engraving.

To lower the bridge the water supply is turned off, and the water before the piston allowed to escape gradually, when, just as gradually, the bridge will descend by its own weight; when it again reaches an incline of 75° and 60° the weights in the high columns will assist in counteracting its strain on the hydraulic piston; when it reaches 40° the weights in the short column will do the same, so that the bridge will come down easily and gradually, while the hydraulic cylinder or piston will never have to do more than lift ¼ of the bridge, or even less, if the weights and chains are arranged accordingly.

The greatest advantage is perhaps that this bridge can be raised and lowered very rapidly, which is of some importance at points where there is much traffic by vessels in the canal as well as by vehicles and foot passengers over the bridge.

IRON BUGGIES.—The introduction of iron buggies is now proposed. An inventor has constructed a vehicle which consists exclusively of iron and steel. For instance, in place of hickory spokes and oak felloes, he employs wrought-iron tubes and T iron; these tubes fit into the axle box at one end, and are riveted to the T iron at the other. The first noticeable effect of the employment of iron for all parts, it is said, has been to add to the weight of the vehicle, this having accrued in spite of the thinness of the parts. The cost also has been enhanced, but for this the augmented strength and durability are regarded as a full equivalent. In appearance it is neat and light.

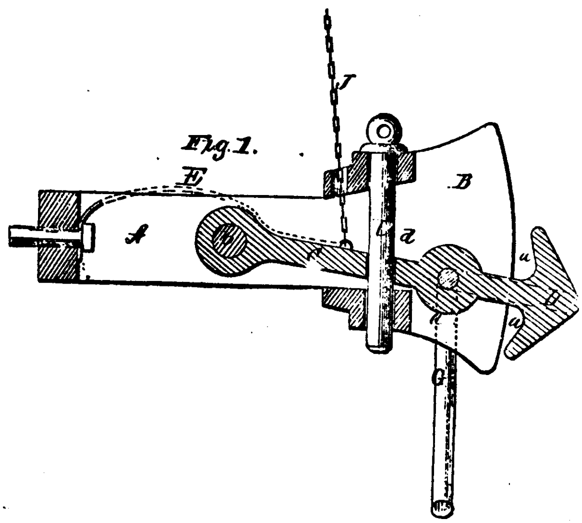


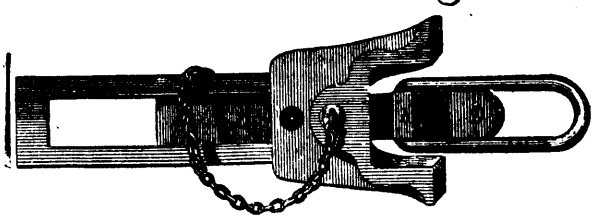
BALANCED DRAW-BRIDGE MOVED BY HYDRAULIC PRESSURE.

Mechanics.

AN IMPROVED CAR-COUPLER.

The accompanying illustrations represent what appears to be a simple and effective improvement in car coupling devices, the construction and operation of which will be understood from the following description. In the engravings, *A* represents the ordinary draw-bar, and *B* the buffer; the latter being provided (as shown in Figs. 2 and 3) with an opening or recess of suitable depth, extending from top to bottom. In the draw-bar *A* the coupling-bar *C* is seen (Fig. 1), pivoted at *b*, and provided with a spear shaped head *D*, bearing at top and bottom the hooks *a a*. The above-named recess in the buffer permits the coupling bar to have free movement in a vertical plane; a provision which, as will shortly appear, renders possible the adaptation of this device to cars of different heights. In the operation of coupling the device is self-acting—no setting or fixing of parts, links, etc., being necessary. When the spear-heads meet, the one which happens to be the higher of the two slides up over the other until the heads have passed and then drops, and the hooks having then engaged, the cars are coupled without human intervention. The depth of the recess in the buffer is just sufficient to allow for the necessary lateral play incident to the turning of curves, but of course not sufficient to make it possible that uncoupling could occur in this direction.





The operation of uncoupling is accomplished with the aid of the chain shown in Fig. 1, attached to the coupling-bar. This chain is designed to be connected with a pivoted lever, so that by a single movement it will raise the head *D*, and disengage it from its neighbor. The coupling may be made of wrought or cast-iron. To accommodate the device to meet all the demands of practice, it is provided also with the common link and pin.

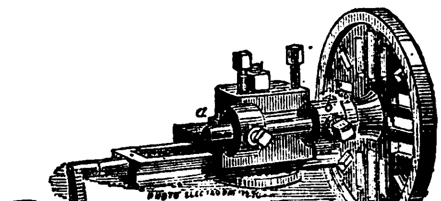
[Editor's Note.—Although we give this illustration for the information of our readers, we may state that we recently have seen a new car-coupler, in use by the Northern Railway Company, Toronto, which far exceeds this one in simplicity, strength and cheapness, and which, in some future number, we will illustrate and describe.]

Turnips and carrots contain about 90 per cent. of water. Their chief value is as a divisor of more nutritious food, to allow the gastric juice to act on it more readily, and as a relish.

Raw Oysters are more digestible than cooked ones. It is believed by some that there is a true gastric juice in an oyster's stomach, which assists in digesting them. This, however, is not known with certainty.

LATH ATTACHMENT.

I send a photograph of an easily made lathe attachment, which will be found useful for holding work while drilling, &c., in lathes not fitted with an overhead motion. It is simply a bracket *a, b*, fitted to the tool-box of the slide rest, carrying a spindle with one end screwed to receive any face-plates or chucks that fit the mandrel. The bracket is kept in position by two pins in the under-side of it, fitting into holes in the bottom piece of tool box. If it be required to drill a straight row of holes the spindle is fixed by the set screws in its bracket, and the work is bolted to the face-plate at the proper level, and traversed across opposite the drill in the lathe mandrel, by the cross-screw of the slide-rest while it is fed up to the drill by the upper screw or the rack and pinion.



For circular rows of holes the centre line of the spindle is adjusted parallel with, and at a proper distance from that of the mandrel. The holes may then be spaced by a division-plate, fixed on the spindle. For holes in the edge of the work the whole top of slide-rest is turned round till the spindle is at right angles with the mandrel.

Work merely requiring to be held fast for drilling is bolted on one side of the face-plate, and can then be adjusted exactly to the drill by the combined motions of the cross-screw, and the face plate on its centre; small round work while drilled in the end can be held in a scroll chuck screwed on spindle same as face plate in figure. Other uses will suggest themselves, and possibly the device is old enough, but as I have not seen it described or mentioned anywhere I send it.

Belfast, October 14. J. Brown.

A PLANING MACHINE FOR GRANITE.

The Boston *Advertiser* for January 2nd contains, under the head of "Granite Planed Like Wood," an article on a new machine for planing stone rapidly, built on the principle of the wood-planing machine. The article begins by saying that when swiftly revolving knives were first made to do the work of horizontal planes upon plank and board, great wonder was expressed, and the planing machine came at once to be the talk of town and country. We have all become used to that and see no impracticability in the use of steel vs. wood in the rapid displacement of the rough surface of the latter.

Next in order one might reasonably expect that some ingenious man would devise a method for the cutting of soft stone, such as freestone, sandstone, and the like, but that chisels or tools of any sort that could be made, would, when driven, dull quickly, and render the operation practically of little value. Such a plan for the cutting of marble could not be entertained, for the hard material must be removed by well directed strokes from a powerful arm. The inventor of the above mentioned machine has now shown what may be accomplished. Disdaining, as it were, to meddle with softer substances, he selects for the test of his invention the hardest of all—granite, and the hardest granite at that—Hollowell. Easily and simply as the surface is removed from a pine board and caused to fly off in chips, the flinty roughness is made to leave the face of the great block, and only a fine powder remains to prove that a strange work has been done by the ingenious application of steel. "If there could be made a tool that would not require constant watching and very frequent sharpening, you might plane granite," said a practical granite cutter. The inventor showed him that for 45 minutes his machine could run continuously and the tools be uninjured, and he was not a little surprised to note the amount of work done by the machine in that short space of time. The tools can be changed in a few minutes, and the whole machine at once put into operation.

IRON PILES.

One of the most important means adopted to secure firm foundation for bridge-piers and other structures on treacherous ground, is that of sinking piles to bear the superincumbent weight. These piles act either by transmitting the pressure direct through their length, to a firm bed below the unstable upper layer—or by the friction of this upper layer upon their sides—or by both. Where wood is plenty, long straight tree trunks, freed of branches and driven in top downwards, or squared timber, answer admirably, save that they are exposed to decay above the water line, and below it to the destructive action of the *teredo*, the *limnoria*, and other forms of animal life. These influences may be very largely counteracted by impregnating the pores of the wood with creosote, salts of mercury or of copper, &c.; and indeed piles have lasted under ground for hundreds and even thousands of years—as for instance the timber pieces "a foot and a half thick and two feet apart" of the famous bridge which Cæsar threw across the Rhine, and which were but recently discovered in the bed of that stream—and, even more remarkable, the piles which the lacustrine dwellers on Lake Leman, in prehistoric times, drove to support their semi-aquatic dwellings. One mode in which timber piles are frequently used in pier foundations is when they are driven down in a group and a masonry pier is built inside of a wooden (or iron) box or pier surmounting them, the space between the masonry and the bed of the stream ebing ballasted with stone, or, still better, filled with concrete.

The employment of iron for foundations is not very old; hardly going beyond 1834, when Mitchell invented the screw-pile; from which time, as piles, caissons or cylinders, iron began to be used quite extensively, not only giving the advantages of lower cost than timber, in many situations, but permitting the erection of structures otherwise almost unfeasible.

The lines of gradation between small caissons and large cylinders, and between small cylinders and large straight hollow piles, being distinct enough to permit of classification, we may confine ourself under the head of iron piles, almost exclusively to screw piles.

CIRCULAR SAW GUIDE.

For protection of workmen against accidents with circular saws, M. Ganne has devised an arrangement in which the appearing part of the saw is covered with an envelope which leaves free that portion of the tool where the wood has to pass. This envelope is suspended rigidly from a small standard fixed on the bank of the machine, being connected therewith by a rack in large apparatuses—a simple rod with sleeve and screw in small ones; so that it can be rapidly raised and put aside when the saw has to be examined or removed; and in any case the arrangement serves to regulate the distance of the envelope from the table according to the thickness of the wood.

CHOKED FEED PIPES.

A correspondent in the *Scientific American* says:—

I send to you by mail a ⅜ inch nipple that was taken from the feed pipe of a ten horse-power portable thrashing engine.

The engine was brought to the shop to have a new check valve put on, as the one that was on was badly worn. To remove the old one, we cut off this nipple close to the boiler, and were surprised to find that the pipe where it entered the boiler had been reduced in area to about 0.01 of a square inch, by deposits of lime.

The persons in charge of the engine said that they had had no trouble in keeping the boiler well supplied with water, and had used it several days this season, before bringing it to the shop, using the steam at 100 lbs. pressure.

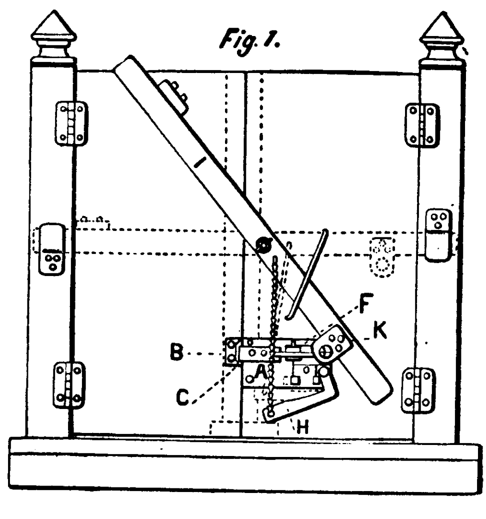
The pump plunger was attached to the cross head of the engine. Had the pump been driven by a belt they would have experienced much trouble in driving it.

Several months ago, a man owning a saw mill brought his force pump to be repaired. He said that he could not drive it with an eight inch belt, while it used to be driven easily with a four inch belt. After examining the pump, I told him that it was all right, and could do nothing for it, that the pipes from the pump to the boiler might be filled with lime (as the water passed through a heater before it came to the pump), thereby obstructing the passage of the water. He did not think much of the idea, but went home with his pump. The next day he returned with the pipes; some of them had become so filled with lime that the passage remaining was not more than one-tenth of a square inch in area.

Inventions.

IMPROVEMENTS ON GATES AND DOOR FASTENINGS.

We give an illustration, in the above cut, of a very ingenious device for fastening a double yard-gate in a very secure and at the same time easy way. The bar on the inside is raised or thrown down by the turning in the lock of an ordinary door key on the outside of the gate, and which entirely obviates the necessity of requiring a person on the inside of a yard to remove the bar and open the gate. *a* is the lock plate, *b* the catch on the opposite side of the gate over which the bolt *c* slides in the act of shutting. The rivets which attach the bolt to the plate slide in slots in the plate. E is a lever, having a bevelled end which is pressed against the bolt C by the spring F. *g* is a bolt which, upon being pushed back by the key, forces back the lever *h*, and the lever in descending draws down the bar of the gate I. *h* is a catch attached to the bar of the gate, and this catch is perforated with a hole so that it may pass over a knob on the lever O, and thus free the bolt C from the pressure of the lever E, which allows the gate to open. When the gate is closed the bar falls into its place and the bolt *g* is pressed by the lever tight up against the catch *b*.



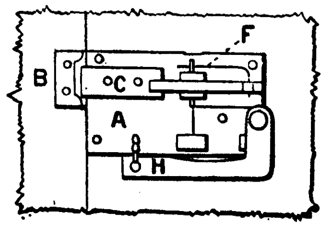


Fig. 2.

This device will be found a very useful invention to those who, often requiring to pass out of a yard with a vehicle, desire to close and secure the gate after them. Mr. Jeffrey Hale Burland, of Montreal, is the patentee.

Repeating Match.—A patent has been obtained for a repeating match, consisting of a stick composed of three parts of chlorate of potash and one part clay, the two substances being thoroughly mixed and formed into a thick paste by the addition of water, which is then moulded and allowed to dry, and placed in a chamber formed in a suitable case. Another stick composed of three parts of amerphous phosphorus and one part clay, prepared in the same manner as the previous one, is placed in a second compartment, and a scraper moves along a platform across the open ends of the two compartments, removing a certain quantity from each stick, and mixing them together, whereby they ignite.

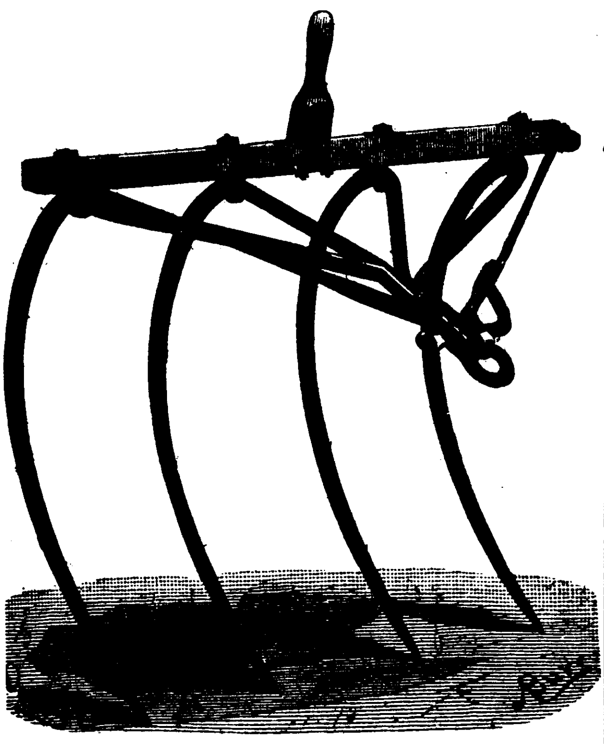
Agricultural Implements.

HARRISON'S HAY FORK.

We illustrate herewith a horse hay fork, patented in the United States. The fork is intended to lift large masses of hay or straw for the use of the threshing machine, or stacking or loading.

The tines are bent so as to grasp the load to the best advantage. These tines pass through the eyes upon the cross-bar, which keep them well apart and steady them. Above the cross-bar the tines are continued and brought together and strongly secured at one point as shown. Strong eyes are secured to the outer ends of the bar and a triangular frame is formed of two other bars or arms, which are secured to these eyes at the ends of the bar so as to allow the fork to swing, and these arms meet in the middle above the head of the tines, forming a strong eye from which the whole is suspended.

It will be manifest that when suspended, the weight of the fork tines will cause the head to swing forward and allow any load to be discharged, unless it is confined in some manner. In order to do this, a hook is formed at the end of the fork, so that this hook just swings clear between the sides of the arms where they are bent to form the eye. A latch is pivoted to one of the arms and extended across the back of the other arm, so that when it is pressed upward into the hook, it will prevent the fork from swinging forward, and as the latch rests across the small space between the arms, it will be seen that it will have great strength to resist the strain upon the fork.



HARRISON'S IMPROVED HAY FORK.

Another great advantage claimed for this latch, is that it lies flat across the back of the fork, and does not project so as to catch or interfere with anything, if it is desired to hoist alongside of a mast or vertical post. In order to keep this latch up and make it catch on the hook, a spring is employed—secured to one of the arms—and this keeps the latch in position. A guiding staple on the opposite arm holds the latch in place and limits the motion.

When it is desired to discharge the load, all that will be necessary is to pull the cord attached to an eye in the outer end of the latch. By this construction, the fork is made very strong, the tines being formed on a single piece each, with a liability to split, and it is very simple and cheap. The latching device is very strong, and by its position across the space in which the head swings, it is capable of resisting a heavy load, and at the same time is entirely out of the way.

Mechanics.

HOW TO MAKE AN EMERY WHEEL.

Joshua Rose writing for the supplement of the *Scientific American* gives the manner of putting the emery and fastening it upon the wheel as follows: The face of the wheel is well supplied with hot glue of the best quality, and some roll the wheel in the emery. The emery does not adhere so well to the leather as it does when the operation is performed as follows: Let the wheel either remain in its place upon the shaft, or else rest it upon a round mandril, so that the wheel can revolve upon the same. Then apply the hot glue to about a foot of the circumference of the wheel, and cover it as quickly as possible with the emery. Then take a piece of board about three-fourths of an inch thick and 28 inches long, the width being somewhat greater than that of the polishing wheel, and placing the flat face of the board upon the circumferential surface of the wheel, work it by hand, and under as much pressure as possible, back and forth, so that each end will alternately approach the circumference of the wheel. By adopting this method the whole pressure placed upon the board is brought to bear upon a small area of the emery and leather, and the two hold much more firmly together. The speed at which such wheels are used is about 7,000 feet per minute. The finest of emery applied upon such wheels is used for cast-iron, wrought iron and steel, to give to the work a good ordinary machine finish; but if a high polish or glaze is required, the wheels are coated with flour emery, and the wheel is made into a glaze wheel by wearing the emery down until it gets glazed, applying occasionally a little grease to the surface of the wheel. Another kind of glaze wheel is made by covering the wooden wheel with a band of lead instead of a band of leather, and then apply to the lead surface a mixture of rouge, crocus and wax, worn smooth by applying to it a piece of flint-stone before applying the work. Others add to this composition a little Vienna lime. For flat surfaces, or those requiring to have the corners or edges kept sharp, it is imperative that such wheels as above described—that is to say, those having an unyielding surface—be used; but where such a consideration does not exist, brush and rag wheels may be used. In Europe comparatively large flat surfaces requiring a high polish are finished upon wooden wheels made of soft wood and unemeried, the polishing material employed being Vienna lime. The lime for ordinary use is mixed with water, and is applied by an assistant on the opposite side of the wheel to the operator. For superfine surfaces the Vienna lime is mixed with alcohol, which increases its efficiency; and here it may be as well to note that Vienna lime rapidly deteriorates from exposure to the air, so that it should be kept as little exposed as possible.

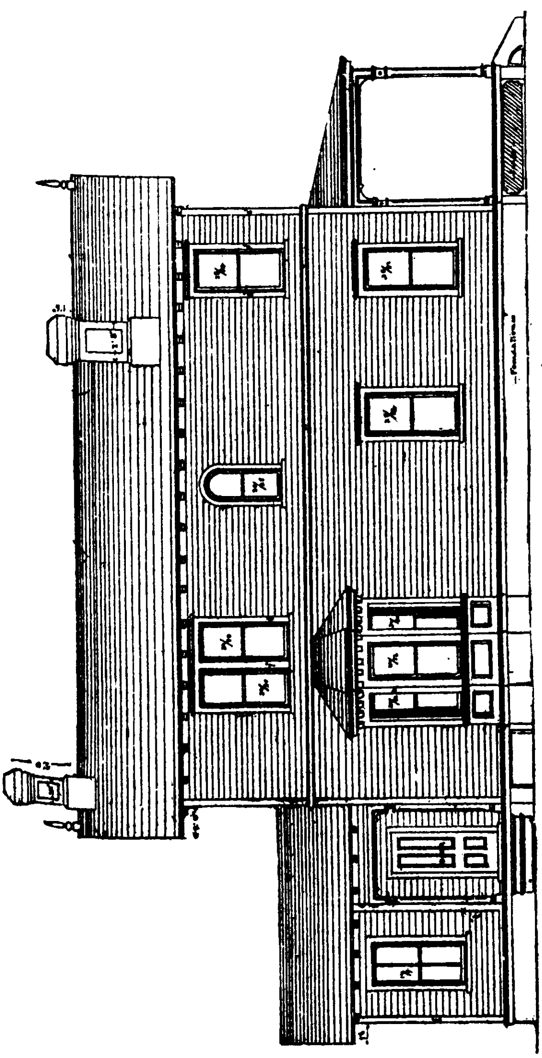
WE learn from the *Deutsche Allg. Pol. Zeit.* that experiments recently made at the Ilseder Iron Works, near Peine, with Herr Albert's patented apparatus for introduction of solid substances with the blast into blast furnaces, have given very favourable results, and the proprietors have ordered the apparatus for two of their blast furnaces. For a test fine coke was used, and about 150 kg. of this, it was found, could be blown per hour in a regular stream into the furnace. This must evidently have a great influence in raising the temperature on the hearth, and with several apparatuses the effect might be considerably intensified.

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

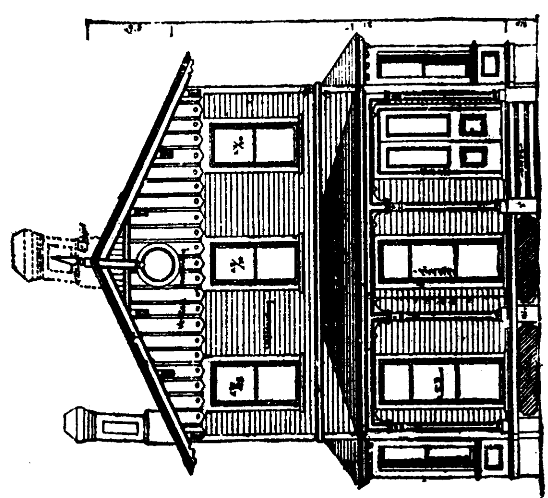
CEMENT FOR LEATHER.—Of many substances lately brought very conspicuously to notice for fastening pieces of leather together, and in mending harness, joining machinery belting, and making shoes, one of the best is made by mixing ten parts of sulphide of carbon with one of oil of turpentine, and then adding enough gutta-percha to make a tough, thickly flowing liquid. One essential perquisite to a thorough union of the parts consists in freedom of the surfaces to be joined from grease. This may be accomplished by laying a cloth upon them and applying a hot iron for a time. The cement is then applied to both pieces, the surfaces brought in contact, and pressure applied until the joint is dry.

DESIGN FOR A PLAIN COUNTRY HOUSE.

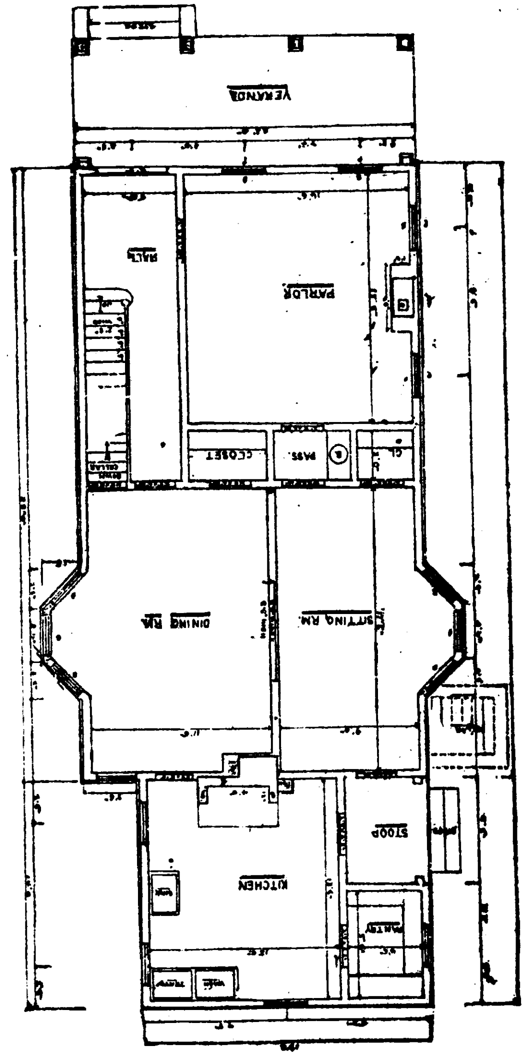
(From the *Manufacturer and Builder.*)



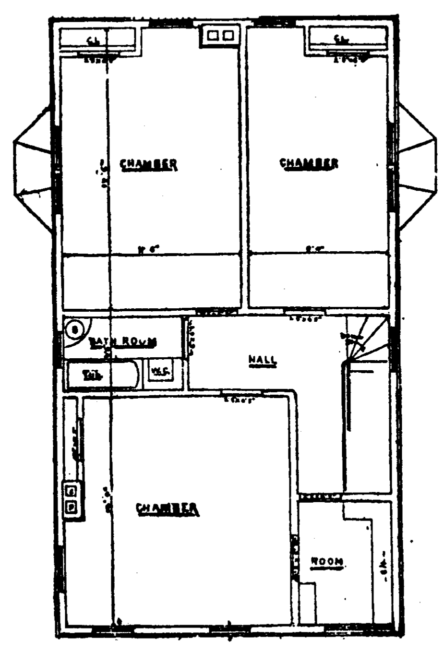
SIDE ELEVATION.



FRONT ELEVATION.



FIRST FLOOR PLAN.



SECOND FLOOR PLAN, THE VERANDAH ROOF NOT SHOWN.

Carvers' and Gilders' Work.

GILDING.

(Continued from March number.)

If there is any knowledge fully in our possession, it is certainly that which comes to us by experience. That a certain material will float in the water, may be proved by a knowledge of its specific gravity; but we feel more fully assured of the fact if we have seen it tried; and our answer to an objector, "I have seen it floating in water frequently," is sufficient to silence opposers. There may be objections raised as to the following methods, but the rules laid down are from practical knowledge, and have been followed thousands of times, and produced capital work. We have made these remarks here, as in many works of some pretensions we have seen the processes of gilding described which could only end in disappointment to the learner or experimentalist. It is likely some of the cheap gilding executed in cities and other large places may not have the amount of work bestowed upon it as recommended in this article, but our object is to lead those seeking information in a path that will crown their efforts with success.

We have described the work usually undertaken by the carver and gilder, the tools he uses, also the preparations necessary for the work, and the present article will be devoted to the description of the work of laying on the preparations and gold.

After repeated drawing up, it is smoothed off with clean water and pumice stone. The thickness of whitening on the wood whould 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.

There are two kinds of gilding practised by the trade; one is called "oil gilding," the other "water gilding;" and the latter is both matt and burnished. Mouldings full of small members, and work full of ornaments, are generally gilt in oil, while broad flat surfaces and plain beads and hollows are gilt in water, and sometimes in oil. Matt and burnish gilding are often seen on the same moulding or piece or work.

In the article on composition ornaments we described the method of getting out, fixing on, and backing up the corners on frames, but have hitherto said nothing on mitreing up mouldings; this we shall consider shortly; and our first essay at gilding will be on an ornamental frame of broad moulding, mounted with corners, and will be "in oil."

OIL GILDING.

After the corners have been backed up and hardened by being in a dry place, the first care of the gilder is to wash the ornaments on the frame to free them from the oil and dust that may cover them in getting them out of the mould, and on to the frame. After this is dry, the coat of *thin white* is evenly laid on the frame. When this is dry, *stopping* is used to fill up the holes and defects in the mouldings, and to square up the corners that are damaged, and make good all ornaments that are chipped. When the stopping is hardened, the frame is ready for glass papering, and the back edge, hollows, beads, and flat parts of the frame are perfectly smoothed with *fine* glass paper. This is important, if good work is required to be turned out. Glass paper for a gilder's use is cut up into pieces about three inches square, and the sizes most generally used are No. 2, 1½, 1, 0. No very coarse glass paper is required. After well brushing out the frame with the *dusting brush*, it is ready for *clay*, which is mixed as in the foregoing article. When this is dry, it is ready for again fine glass papering, and next a coat of what is technically termed *clear cole*. This is a parchment size thinned down with water moderately, and put on warm. The object of thus sizing the work is to keep the next coat, which will be oil, from sinking into the surface. Two coats of this size are usually laid on, and it is much better to lay on two or more coats of weak than one of strong size, as the latter sometimes, if too strong, peels up. Size that has been kept a little too long, and commenced running or spoiling, is known to make first rate *clear cole*. After the size is dry, the frame will be ready for oil, and the workman mixes enough oil gold size to about the consistency of cream, and strains it through some clean linen rag screwed up tightly, forcing out the oil size. This oil gold size is laid on the frame very thinly and evenly with a brush. The thinner it is laid on the better, but great care must be exercised to touch the whole of the surface of the moulding, and to be most particular to brush in the oil to the bottom of the work. It is usual to put work in oil the last thing at night, so that it may be ready for gilding in the morning. It is known to be ready for gilding by the oil being *just tackey* and *nearly dry*, and in this state the gold will adhere firmly, and brush off bright; but if the oil has been laid on too thick, or the gold applied when it is too tackey or not dry enough, it will be dull, and greater care must be exercised in *skewing* in the gold, or the more prominent parts will have the gold brushed from the surface.

As before described, the gilder blows the gold out on the cushion, and cuts the leaves of gold up into convenient sized pieces to suit the various parts of the frame, and takes them up with the *tip*, and lays them on the frame till it is well covered with gold. In a frame gilded in oil the gold is ragged, and in many places of double and treble thickness. The gold is first carefully pressed down with a *dabber*, and then skewed well in with a *badger*. A rather long-haired brush set in quill is used, called a *skewing* brush, to brush out and off the frame all the skewings remaining. After this operation, the frame is ready for *finish size*. This is clear size, rather weak, laid on evenly with a hog's hair brush, and if it is thought desirable to deepen the colour of the gold, a little *ormolu* is added in order to give it a deeper and richer colour.

The *skewings*, which are the small particles of gold not required on the frame, are carefully put away and sold to the gold beater when a sufficient quantity has been collected.

The frame will now be complete when the back edge is brushed over with Oxford ochre, mixed with size.

WATER AND OIL GILDING.

After going through the operation of gilding a frame in oil, which is comparatively simple, the reader will be prepared to gild a more elaborate frame, finished with brilliant burnish on the corners, beads, &c., and a broad *double gilt* flat and hollow on the inside. It may be mentioned here, all the best work that is flat, such as broad insides to picture frames, spandrills, flat looking-glass frames, &c., are double gilt; and this is done to give the work a better colour and more solid appearance. That work of this class is superior there is no doubt, and that it was thought so in the time of Shakespeare may be inferred from the speech of Fabian in *Twelfth Night*, who says—

The double gilt of this opportunity you let time wash off."

Some of the gilder's clients may perhaps think he overcharges a little for his work, but when he is anxious to please his customer with good work, it should be borne in mind both gold and time must be paid for, that have contributed to the result.

We will now describe the operation of gilding a broad frame made of Alhambra moulding, with corners and a broad flat inside. As a general rule the broad flat insides to frames are made separate, and fit into the rabbet of the outside frame when made. This is convenient to the gilder, as he gilds the flat in water apart from the frame.

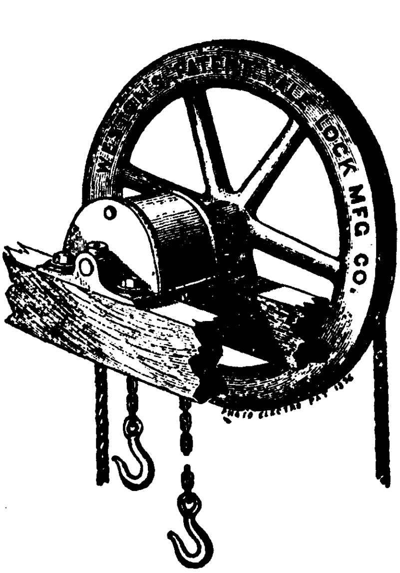
The first thing the workman is careful to do is to see that the frame is free from dust, dirt, or grease; if not, to wash the frame with a brush and clean water, care being taken not to take off the sharpness of the ornaments in the operation. After it is dry, a coat of *thin white* is then applied, and then all holes, &c., are made good by *stopping*, and the parts to be burnished receive three or four coats of *thick white*. When the last coat of thick white is nearly dry, pass over the parts with the finger, which will help to smooth the rough surfaces. It may perhaps puzzle a novice what parts should be burnished in various descriptions of work, but a good rule will be to take the most prominent plain parts of the ornaments and the beads; and in the case of scrolls on a chimney glass, the scrolls fixed on for burnishing should be followed throughout with burnish. It requires taste and judgment to so distribute the burnish in any work that it may not be overdone and lose its effect, but judiciously placed, so that the *matted* portions will stand in strong contrast, and produce brilliant work. The frame is then carefully and thoroughly glass-papered till it is smooth, when it receives a coat of *clay*, and is again glass-papered and brushed down. Two coats of size, evenly laid on, follow, taking care that the first coat is thoroughly dry before the second is laid on. When this is done the frame is "put in oil," in the same way as before mentioned, and afterward all the beads and ornaments which have received the coats of thick white, and selected for burnishing, must be rubbed clean of every particle of oil. This is usually done by wetting a piece of calico, and ringing it out: commence by putting it round the second finger of the right hand, and pass it carefully over the parts to be burnished, changing the surface of the calico on the finger very often. Should any of the other parts of the frame be touched by the damp calico, it will be necessary to again apply the oil brush to remedy the accident, and a small camel's hair brush will sometimes be needed to touch in small imperfections. Although it is thought that every particle of grease has been wiped off, yet it is necessary the next morning, before laying the gold, to go over all the parts required for burnish *clay*. This is done to prevent the possibility of any gold adhering, as it would have to be glass-papered off before putting on more preparation. The frame is then gilded as before described, and the gold skewed into the bottoms of the ornaments; after which, if there are any faults in the gilding, they can be rectified by taking a small camel's hair brush, and wetting it in the mouth, apply it to the spot, and lay gold enough to cover it. The frame must then be *finish sized* once, as before mentioned.

(*To be continued.*)

SAFETY DOUBLE HOIST.

A noticeable feature in this hoist is the saving of the time ordinarily consumed after raising a load, in bringing the hook and chain down again for the succeeding load. The hoisting chain is double ended, the hook on one end raising as the other descends.

Thus the advantage occurs in transferring goods downwards, that one hook is always left at the top of the hoistway, ready for lowering the succeeding load. The double-ended chain is "pitch-chain," having links of precisely uniform dimensions, made to fit into and engage with corresponding recesses and projections in the hoisting sheave over which it works. The hoisting sheave, or chain wheel, is central in the machine, and is screw-threaded to traverse like a nut upon the screw-thread cut on the shaft of the sprocket or rope wheel. When hoisting or lowering upon one hook, the chain sheave is automatically braked against a



left-hand ratchet wheel and disk brake; and against a right-hand ratchet and brake when the other hook is used. The operator can use whichever hook is nearest to hand. He can pull the hand rope either to hoist or to lower. He may "let go" whenever it suits his convenience, and the load will take care of itself; remaining in suspension until hoisting or lowering is resumed. Although the lowering motion is self-checked, so that the load cannot possibly run away, a considerable speed, but still a safe one, may be obtained in lowering, by imparting velocity to the sprocket wheel, which is purposely made heavy to act as a fly wheel, for fast lowering.

The safety and despatch afforded by this little hoist, make it a decided economizer of time and labour. Larger sizes are in course of preparation, as also a full line of platform elevators possessing equally marked advantages.

NEW CONTINUOUS CALK HORSE SHOE.

When a prominent horseman states that in the city of New York there are not ten horses in a hundred that have been upon our street pavements one year that have sound feet, and when eminent veterinary surgeons say that nearly all of their business comes from the present mode of shoeing horses, it becomes a matter of serious consideration to owners of horses to know whether there is a way of avoiding the evil. The remedy seems to lie in the adoption of a shoe of standard form adapted to the peculiarities of the horse's foot and capable of being easily applied by any blacksmith. A shoe which, we are informed, fulfils all requirements has been recently patented in the United States.

Fig. 1, in the engraving, represents the shoe as seen from the top, showing a level bearing surface. Fig. 2 shows the under or calk side of the shoe.

Fig. 1 Fig. 2

This shoe is made from an L shaped bar of steel, the steel being, by a patented process of manufacture, completely enveloped in a coating of tough iron, which renders it capable of being bent hot or cold, and imparts to it the desirable qualities of lightness, strength, durability, and elasticity. The bars being cut into suitable lengths and the ends of the pieces sheared off, they are then bent into shape around forms or dies made from drawings of the foot; the nail holes are then punched, and the shoe is complete.

The shoe has a continuous calk, which is similar in form to the crust or wall of the hoof, and is, therefore, the most natural, and, as stated by the manufacturers, the most efficient shape for a horseshoe. The upper surface of the shoe has a narrow beveled edge or rim, which takes the place of the clip in the ordinary shoe.

It is stated that the peculiar form of the shoe adapts it to all kinds and conditions of feet. The manufacturers state that it has cured tender feet, when existing, in every instance where the shoe has been tried; and the change which takes place in the tender footed animal, that has had an old shoe replaced by this, is said to be quite remarkable. While formerly he gave expression to the uneasiness and pain from which he suffered, by frequently shifting his weight alternately from one foot to the other, with the new shoe he stood squarely upon his feet without a sign of discomfort, showing clearly that he was at his ease.

The many advantages claimed for this shoe cannot be well enumerated here, but we are informed by the manufacturers that it is largely in use, and is giving excellent satisfaction.—*Scientific American.*

NOTE.—We furnish this simply for information; it is a patented invention.—ED. S. C.

INSTANTANEOUS PHOTOGRAPHS.—The success of Mr. Muybridge of this city, in taking a number of instantaneous photographs of a horse at full speed have attracted much notice, not only at home but also abroad. M. Marey, in *La Nature*, who has made extended investigations upon the subject of the analysis of animal motions, appears to have been greatly struck by the pictures of Mr. Muybridge, and believes that his success provides an admirable means of studying in every successive position of motion the very difficult problem of the flight of birds. "What beautiful zootropes," he suggests, "might be obtained by this method. We might see in their true paces all sorts of animals; it would be a sort of animatic zoology. As to artists, it is a revelation for them; for it furnishes the true attitudes of motion; those positions of the body in unstabled equilibrium in which a model cannot 'pose.'" In connection with this last point, it may be of interest to notice that many of the attitudes exhibited by Mr. Muybridge's pictures are very unlike the stereotype ideal.

Health and Home.

BAD TEMPER AND INSANITY.

Says the *Popular Science Monthly*: "Passionate people — the hasty kind—who flare up in a blaze, like fire to tow or a roal to powder, without taking time to inquire whether there is any ground for such a pyrotechnic display, and then get more furious when they find out there was no cause for their fiery feats, may learn a useful as well as a serious lesson from an item in Dr. Blanchard's report of the King's County Lunatic Asylum, that 'three men and three women became insane by uncontrollable temper.'

"We all feel a sympathy for one who has become demented from loss of kindred, from disappointment, and from a hard lot in life; but we can have no such feeling for quarrelsome, ill-natured, fretful, fault-finding, complaining, grumbling creatures the greater part of whose every day life tends to make those whose calamity it is to be bound to them, as miserable as themselves. Bad temper is a crime, and, like other crimes, is ordained in the course of nature, to meet, sooner or later, its merited reward. Other vile passions may have some points of extenuation, the pleasure, for example, which may attend their indulgence, but ill-nature—that is, a fretful, fault-finding spirit, in its origin, action and end, has no extenuating quality; and, in the application of the old principle, 'with what measure ye mete, it shall be measured to you again,' will find a most pitiable end. Therefore, with all the power that has been given you, strive and strive for life, to mortify this deed of the flesh. Watch hourly, watch every moment against the indulgence of a hasty temper, as being offensive to yourself and contemptible in the eyes of your fellow man—contemptible, because for the person who possesses it, and knows it, yet indulges in it, and makes no effective efforts to restrain it, no human being can have any abiding attachment or respect, founded as it is in low morals, or low intellect, or both."

CARE OF CHILDREN'S EYES.—It is no uncommon thing now to see, or hear of, mere children using eye-glasses, because of some defect of sight. Myopia (for near-sightedness) is the most common defect, and it is said to be manifestly increasing among school-children, in other countries as well as in our own. The eyes of studious children are especially liable to suffer. Reading tires weak eyes, and eyes grow weak or deceased from too steady application to books. There are many disadvantages connected with learning the alphabet in very early childhood, and danger to the sight may be reckoned among them. The eyes of children, like all their other organs and faculties, are adapted to the study of natural objects, or the phenomena of the world into which they have lately come. This study is play to them, and tends to a healthy development of both mind and body. Their introduction to the fine long lines of little black letters in print should not come too early, or too rapidly—not until a love for nature and a faculty for observation have been so cultivated that reading will not be immoderately attractive. Then they must learn to read and study in a proper light, one that shines upon the book or paper, and not directly upon the eyes. A hanging lamp is much to be desired, and those who read in the evening can sit so that the light comes down upon the page from behind them. In gathering about the evening lamp upon the table, those who read should sit so that the light shines upon the book or paper from over the shoulder—the left shoulder if practicable. The eyes suffer severe strain from reading when lying down. One who is too tired to sit up, is too tired to read. When the body is enfeebled by disease, the eyes are weak sympathetically and should not be allowed close application. Reading in railway cars, or in any place where it is impossible to keep a steady focus for the sight, causes strain and injury to the eyes. Children should be taught to avoid all these injurious practices. Most of the youthful cases of near-sightedness within my knowledge are those who began to learn piano-playing when quite young, and it seems to me that the fixing of the sight upon the notes, while the energies are at the same time bent upon the schooling of the fingers, has a peculiar tendency te develop near-sightedness. Ought not a child's music lesson to be made very short, and the hours of practice few and of brief duration? I think so not only for the sake of the eyes, but also for the sake of the spinal column and the nervous system.

Amateur Mechanics.

CENTERING AND STEADYING.

To center a cylindrical piece of metal readily and accurately is a very simple matter when the workman is provided with tools especially designed for the purpose, and it is not difficult when an engine lathe or even an engine rest is available; but to do it easily and properly in an ordinary plain foot lathe may puzzle some of the amateur mechanicians.

Although some of these methods are well-known they will nevertheless be described for the benefit of some who may require the information.

The method of centering shown in Fig. 1, is one of the most common where the lathe is provided with an engine rest. A forked tool A is clamped in the tool post in such a position that a line drawn from the point of the tail center will bisect the angle of the fork. A square pointed center G is inserted in the tail spindle and moved against the end of the rod, being centered with a slight pressure, the tool A being at the same time moved forward by the screw of the engine rest until the rod turns smoothly in the fork and the square pointed center has found the center of the rod; the tail spindle is then moved forward until the cavity is sufficiently deep to permit of starting the center drill. The angle of square center G for very hard material should be a little more obtuse than that shown in Fig. 4. In any case, it should be of good material and well tempered.

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

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

Work that is too large to be readily centered in this manner is often centered approximately by means of the universal square as shown in Fig. 5. A diametrical line is drawn along the tongue of the square, the work is then turned through a quarter of a revolution, and another line is drawn. The intersection of these lines will be the center, at least approximately.

This point may now be marked with a center punch, and the work may be tested in a lathe. If it is found to revolve truly on the centers it may be drilled, otherwise the center must be corrected with the center punch, and the work again tested in the lathe.

After centering by any of these methods, the center must be drilled and countersunk with a suitable tool, so that it will fit the lathe center, as shown in Fig. 6. The angle of the lathe centers should be sixty degrees. To insure uniformity in everything pertaining to the centers, the center gauge, shown in Fig. 7, should be used for getting the required angle on the lathe centers and on the drills used in centering.

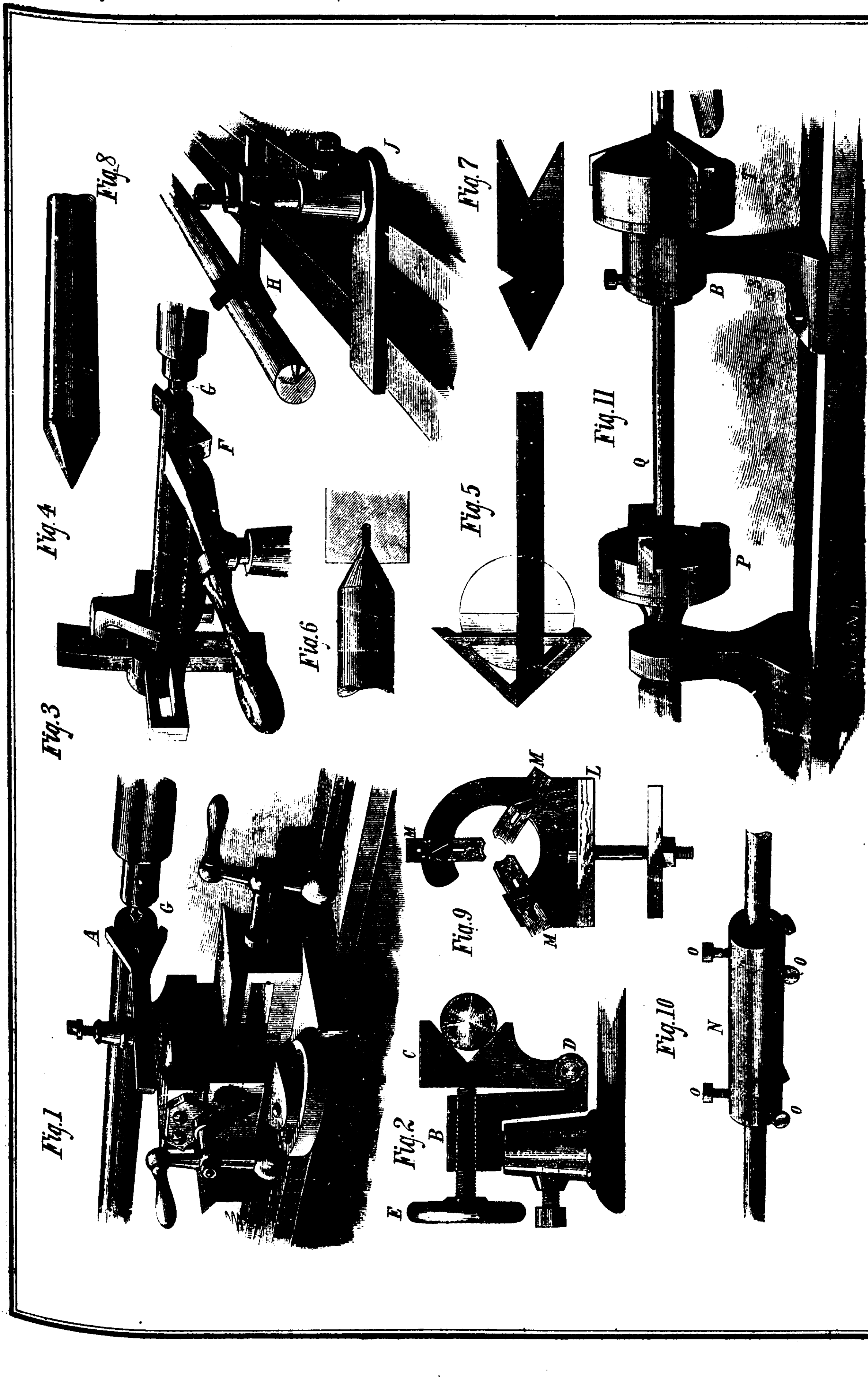
The matter of steadying long, slender rods while being turned in the lathe is often perplexing.

In some cases it may be done tolerably well in the manner illustrated in Fig. 8. The fork, H, is supported by the standard I, which is inserted in the socket of the rest support J. The device shown in Fig. 2 may be used in a similar way.

Fig. 9 represents a steady rest, the construction of which will hardly need explanation. For light work it may be made of wood; the upright being secured to the cross-piece L, which rests upon the lathe bed. The slotted pieces M are adjustable lengthwise to accommodate the size and position of the shaft. When it is required to support a bar which is not round, the sleeve N, shown in Fig. 10, is employed. It slips over the shaft and revolves in the steady rest. The bar is centered by the screws O.

The device shown in Fig. 11 is used where a hollow mandrel lathe is not at hand. A piece of gas pipe Q is held by the chuck P, and is secured by a set screw in the sleeve B, which is journaled in the standard S, and carries the chuck T.

This arrangement may also be employed for turning the ends of long rods where it is not desirable to put them regularly on the centers of the lathe.—*Scientific American*.



CENTERING AND STEADYING TOOLS.

THE COMPOSITION AND WORKING OF ALLOYS.

Of all the known metals in use at the present time, iron and platinum are the only metals that bear welding and forging well, and iron or steel is the only metal that admits of being hardened beyond that degree which may be produced by simple mechanical means, such as hammering, rolling, &c. Yet all the metals, with the exception of platinum and its kindred metals, admit of ready fusion; and their fusibility offers an easy means of uniting them, and many of them combine with other metals with great readiness, and by mixing two or more of these metals by means of fusion an alloy may be formed that is of an entirely different nature from any of its constituents, and by the process of founding alloys may be cast into any desired form. The malleability and ductility of these metals, as well as their hardness and brittleness is often increased by alloying with each other, and these qualities are often turned to many useful and varied purposes. The ready fusion of these metals also affords a ready means of uniting two or more metals by the fusion of a third metal by the process of soldering. Some of these metals will unite with others in almost any proportion, and form a perfect chemical mixture, which in many cases produces a superior metal to either of its constituents, while in others the chemical affinity is limited, and they will only unite in certain proportions; and when mixed beyond these proportions the alloy is only a mechanical mixture, and often forms an inferior metal to either of its constituents. I have given several recipes for the formation of alloys by mixing these different metals; but in using these or other recipes in forming alloys the founder must not be guided entirely by the recipe, but he should use his own judgment as well, for the metals may contain certain impurities, or, as it is termed, be a poor metal, which will produce different results; and in order to produce good alloys a long practical experience is as essential as good recipes, for a man who has not had practical experience in forming alloys can no more produce a perfect alloy from a recipe than a school boy can produce perfect writing from his first copy.

ALLOYS OF IRON.

All admixtures added to iron make it more fusible than when pure, although the admixtures added may not be a metal. Lead can be alloyed with iron in small quantities. A small amount of lead causes iron to be soft and tough, but too much causes it to be extreme cold-short. Copper, if alloyed with iron, causes it to be extreme red-short, and more than 1 per cent of copper will cause it to be cold-short; but a small amount of copper will increase the strength of iron when cold. Arsenic imparts a beautiful white colour to iron, resembling silver, but it makes it very brittle. Tin, when alloyed with iron, makes a beautifully fine white metal, and when the tin and iron are alloyed about half-and-half the alloy is as hard as steel, but it cannot be forged. Chromium, alloyed with iron, makes an alloy that is as hard as diamond, but it is very difficult to make this alloy. Silver, alloyed with iron in small quantities, causes the iron to be very hard and brittle, and very liable to corrode. Gold can be alloyed with iron in any amount. It causes the iron to be more yellow and tough. This alloy is principally used as a solder for small iron castings. Carbon makes iron more fusible. From 1 to 2 per cent. of carbon added to iron makes hard cast iron, and from 5 to 6 per cent. makes No. 1 foundry iron. More than 5 or 6 per cent. of carbon causes iron to be very brittle, and less than 1 per cent. of carbon causes iron to be very hard and brittle. Sulphur causes iron to be both hard and brittle, either when hot or cold, and it causes molten iron to be short-lived. Fuel with sulphur in it should not be used for melting iron in contact with the fuel. Phosphorus is very injurious to iron. One-half of 1 per cent will cause iron to be very hard and brittle when cold, but it imparts a brilliant and white colour to iron more perfectly than any other metal. Silicon makes iron brittle and hard. It has a similar effect on iron to phosphorous, but it is not near so injurious to the iron. All cast iron contains more or less carbon, sulphur, phosphorus, and silicon, and as these substances predominate they form hard or soft, strong or brittle irons; and as all anthracite coal and coke contain more or less of these substances the anthracite or coke iron is less pure and more variable than the charcoal irons, and on account of the uncertainty of the amount of these impurities contained in cast iron is it very difficult to make an alloy of iron and other metals with any certainty as to the result, and for this reason alloyed iron is very little used.

GERMAN SILVER ALLOYS.

German silver is composed of 80 parts copper, 20 parts nickel, and 33½ parts zinc. The best quality of German silver is composed of 100 parts copper, 50 parts nickel, and 50 parts zinc. The white copper, or packfong of the Chinese, which is the same as the German silver of the present day, is composed of 41 parts copper, 17 parts nickel, 13 parts zinc, and 2½ parts iron. A very hard German silver is made of 8 parts copper, 4 parts zinc, 2 parts nickel, and 1 part iron. This alloy is very tenacious and ductile. A still harder German silver is made of 16 parts copper, 8 parts zinc, 4 parts nickel, and 3 parts iron. The finest quality of German silver that is made is composed of 16 parts copper, 8 parts nickel, and 7 parts zinc. Ten parts copper shavings and 4 parts arsenic, arranged in a crucible in alternate layers, and covered with a layer of common salt, make a beautiful white alloy that is almost equal to silver. In making this alloy care must be taken to avoid the fumes of the arsenic.

BRASS ALLOYS.

A very good brass is made of 16 lb. of copper, 8 lb. of zinc, and 1½ lb. of lead. This lead should be added after the copper and zinc have been melted together. These proportions of the different metals make better brass than can be made with zinc and copper. For very light castings the lead should be omitted, as it makes the alloy less fluid; but in heavy castings it makes them more solid and clean. Button brass consists of 24 parts copper to 15 parts zinc. Red brass made at Hegermuhl consists of 5½ parts copper and 1 part zinc. Brass that bears soldering well consists of 16 parts copper, and 6 parts zinc. Brass for ship nails consists of 20 parts copper, 16 parts zinc, and 2 parts iron. Red sheet brass is made of 9 parts copper and 2 parts zinc. Brass for sheathing, bolts, fastenings, &c., is composed of 6 parts copper and 4 parts zinc. This composition forms an alloy that may be rolled and worked at a red heat. Brass for pumps, and machinery requiring great tenacity, is made of 32 lb. copper, 3 lb. tin, and 2 lb. old brass. If it is desirable to have the wheels harder a little more tin may be added. An alloy for turned and finished work is made of 32 lb. copper, 4 lb. tin, and 3 lb. old brass. For nuts of coarse thread one half-pound more tin may added. As more tin is added to alloys of copper and zinc, or copper and old brass, the alloy becomes harder. Razors have been made of an alloy of 32 parts copper, 5 parts tin, and 5 parts zinc. The best white hard metal for buttons is made of 16 parts copper, 2 parts zinc, and 1 part tin.

LEAD AND COPPER ALLOYS.

Seven parts lead and 16 parts copper make a very cheap alloy, but it is rather short and easily broken. Two parts lead and 8 parts copper make a red-coloured alloy that is very tough. A red-coloured and ductile brass is made of 2 parts lead and 16 parts copper. Ordinary pot metal is made of 6 parts lead and 16 parts copper. This alloy is very brittle when hot, but tough when cold. The alloys of copper and lead are all very brittle when hot. More than one-half pound of lead cannot be alloyed with one pound of copper, for the copper will not unite with the lead, and the lead will ooze out in cooling. Alloys of lead and copper are very little used. Lead and copper alloys have a bluish, leaden hue when much lead is used, and are principally used on account of their cheapness.

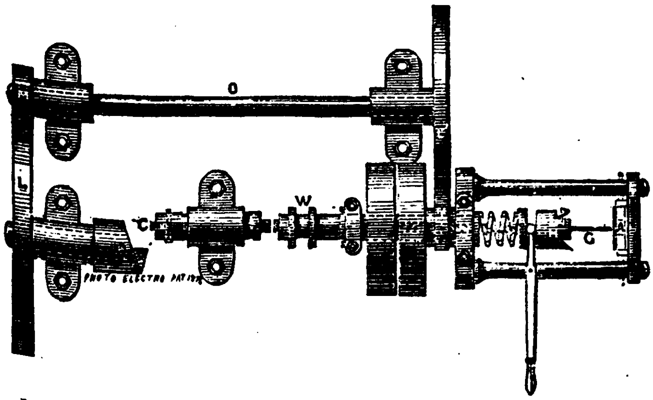
(To be continued.)

AMERICAN COMPETITION IN EUROPE.—The *British Mercantile Gazette* says: The American exports of hardware from the port of New York to Europe, for the quarter ending March, show a considerable increase over the corresponding period of last year. The increase is mainly in household and builders' hardware, mechanics' tools, saws, cutlery, etc., which in some instances are being offered in England at quotations so low as to make it impossible that the manufacturers can derive but the barest margin of profit. A letter from New York states that advices then in hand from Europe were encouraging, and that dealers in one or two lines were quite sanguine of their efforts to create European trade. Travelers are now in England representing American houses, and there are American merchants in Sheffield who are prepared to take orders for hardware and deliver the goods within three weeks. In Canada, in a few special lines, the Americans are having it pretty much their own way. No steel rails are being sent from Sheffield to America, though once this was one of the best markets. These figures show how the Bessemer steel rail trade in America is growing: In 1873 the manufacture in the United States was 129,015 tons; in 1874, 144,914 tons. This increase continued each succeeding year until 1877, when the total was 432,169 tons.

NUT-TAPPING MACHINE.

An improved nut-tapping machine has been patented by Mr. T. Mason, of Birmingham, which is said to be capable of turning out a much larger amount of work with reduced labour, owing to the application of the self-acting principle.

The machine consists of the usual framework, with driving shaft and gear. It is fitted with a long box chuck or hopper, in which the blanks are placed ; the tapping tool is fixed at the lower end of this chuck, and is started by means of a cam. As each nut is tapped, the tool is withdrawn by means of a balance weight, freeing the nut from the chuck, when another blank falls into position for tapping, and so on until the chuck or hopper is empty. In front of the chuck there is a slide guide, worked by a lever from the balanced weight, which is to prevent the twisting or dropping of the nut from the chuck until the tapping tool is re-started.



In the engraving, which represents a plan of the machine, seen from above, A is the box chuck into which the blanks are fed, G is the tapping tool held in a spring chuck, H, carried on a shaft driven in the usual manner by a pulley and belt. L and M represent toothed wheels and pinions, by which motion is imparted to a screw cam, B. This cam rubs against a friction roller, C, the impact starting the tapping tool into the blank. When the nut has been tapped, the tool is withdrawn by the action of a balance weight connected by means of a lever to the collar, W ; the same lever serves also to work a slide guide placed in front of the chuck to prevent the nut under operation from twisting or dropping until the tap is re-started. The tool, G, is held in the chuck, H, until its shank is covered by the tapped nuts, when by actuating the lever, the tap springs out, and the operations are repeated.

PROTECTING IRON.—A new method of protecting iron has recently been introduced, which is described as follows, by *Iron* : The method is to coat the surface to be protected with a thin film of borate of lead having a little oxide of copper dissolved in it, and having also suspended in it bright scales of precipitated platinum. A red heat is employed to fuse the composition, which is either applied with a brush or employed as a bath, in which small articles may be dipped. Its effect is, to cover the iron with a thin glassy coating of a bright grey tint, not far removed from that of polished iron itself, and unaffected by sewer gases, dilute acids and alkalies, and the heat of a kitchen fire. Modifications of the compositions give the means of imparting different colors to the coating, and these are as easy of application as the platinum grey just mentioned. The effects are really very good, and show how ornamental an iron grating of neat pattern, or an iron frieze might be in front of a gallery in a large building, or in any equally elevated position. Cost is in all cases a most important feature of preservative operations. We are told that the cost of platinum is about equal to that of applying three coats of paint, and about one-tenth of that of electro-plating with nickel.

MEAN DISTANCE OF WATER MOLECULES.— Hermann Herwig concludes that no two molecular layers in water can be more than 1·86 of a millionth of a millimeter apart, and that the same is true with regard to the mean distances of adjacent molecular centers. Sir William Thomson had previously estimated the least value of the same distances at 0.05 millionths of a millimeter. These two estimates, one being less than four-fold the other, furnish satisfactory approximations to the true value.

Educational.

MECHANICAL EDUCATION.— Mechanical education in Russia has been carried to a point of success not yet reached in this country. Col. Forney, of the Philadelphia *Press*, writing from the Paris Exhibition, remarks that American progress' has astonished Europe, yet "Germany, Switzerland and France have methods and systems that deserve to be studied. Even Russia may be a model for all of us. Yesterday I saw some machinery at the Exhibition, and my admiration increased as I was told that much of this exquisite work was made by the youth, many of them sons of the best families, sent into the machine shops to learn trades as a part of their education. There was no alternative ; they were compelled to pass this ordeal. The Government is the master, and young Russia must obey ; and now obedience becomes a delight ; and it is as much the fashion to finish a practical education in this way, as formerly it was the fashion to pass through a school or an academy, or college, for the easy acquisition of superficial accomplishments."

MATHEMATICAL DRAWING INSTRUMENTS, by W. F. Stanley (E. and F. N. Spon), is the fifth edition of a very useful book, which has been much improved by the addition of fresh matter. Several new instruments are described, and the book having been selected as a "science and art" prize, mainly because of the hints it gives on drawing and colouring, Mr. Stanley has extended that part, and those interested will find in his remarks on perspective much food for thought. — " London Science Class-books," edited by G. C. Foster, F.R.S., and P. Magnus B.Sc., B.A. (Longmans). — " Hydrostatics and Pneumatics," by P. Magnus ; " Botany," by W. R. McNab, M.D., (two divisions) "Zoology," by A. Macalister, M.D., (two divisions), are well adapted for their purpose—viz., use in schools, and as stepping-stones to more advanced works. They are neatly printed and well illustrated.

WHY ARE WE RIGHT-HANDED ?—Investigations which were very recently carried through by a French physician, Dr. Fleury, of Bordeaux, have adduced facts showing that our natural impulse to use the members on the right side is clearly traceable to physiological causes. Dr. Fleury after examining an immense number of human brains, asserts that the left anterior lobe is a little larger than the right one. Again, he shows that, by examining a large number of people there is an unequal supply of blood to the two sides of the body. The brachioephalic trunk which only exists on the right of the arch of the aorta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger. The left lobe of the brain, more richly hæmotised than the right, becomes stronger ; and as, by the intertersection of the nervous fiber, it commands the right side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the natural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery. The augmentation of blood we have already seen suggested ; but the reason for it is here ascribed to the relative size of the artery, and not to any directness of path from the heart. Dr. Fleury has carried his investigations through the whole series of mamalia ; and he finds that the right-handed peculiarities exist in all that have arteries arranged similar to those of man. At the same time such animals, notably the chimpanzee, the seal, and the beavers, are the most adroit and intelligent.—*The Eclectic.*

INDIARUBBER FOR BOOK-BINDING.—The leaves must be made single, and squared true in the press. The back edge is then rounded by allowing the sheets to form themselves in a grooved recess or mould : when true the book must be held tightly in the press between boards, exposing the rounded back : the back has then the indiarubber solution applied to it ; when dry another coat is put on, and on this a piece of calico, by which the book is held in its case. The indiarubber can be bought already in solution, or may be made by dissolving in naphtha.

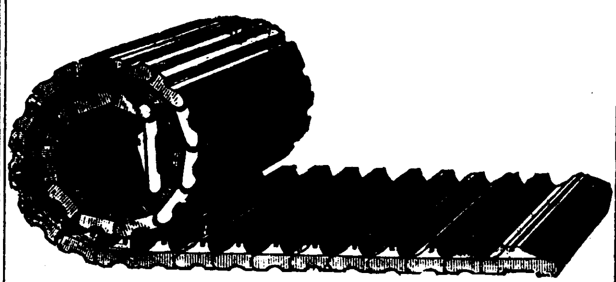
INDESTRUCTIBLE WRITTING INK.—According to the *Pharmacist*, an ink that cannot be erased even with acids is obtained by the following receipt :—To good gall ink add a strong solution of fine soluble Prussian blue in distilled water. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destruction of the paper. The ink writes greenish blue, and afterwar ds turns black.

FLUTED PORTABLE FLOORING AND MATTING.

A new article of manufacture, intended for flooring and matting, has lately been introduced into the United States. A specimen of the same is represented in the adjoined engraving, partly rolled up; it is chiefly intended for crowded and much trodden floors, stairs and landings.

It is made of strips of hard wood, attached by strong thread-work upon wire cord, in such a way as to be easily rolled up. At doorways and in vestibules the sharp edges of the ridged surfaces effectually remove dirt from the feet and drop it into the grooves between, where it remains undisturbed until removed and swept, or dropped out of the mat in cleaning. This it does in common with some other kinds of matting, but more neatly. Used inside of crowded halls, passage ways of stores filled with costly goods, etc., it performs an important office in regard to dust. This it collects and retains out of reach of the feet, which otherwise would continually sweep it about the floor and fill the air with it.

For the preservation of costly floors of wood or marble from wearing into holes where much trodden, as in hotels, apartment houses, etc., it is at once a durable and handsome article, as it can be varnished, or otherwise kept in as perfect order as the floor itself. It is also a preventive against slipping.



FLUTED PORTABLE FLOORING AND MATTING.

For greater dryness and cleanliness, a requisite not generally secured in matting, it is grooved underneath as well as on its upper surface, thus affording a free passage of air, which is a great advantage in case there is a damp floor or carpet. Where there is most excessive wear, the treading surface is inlaid with iron, steel, or other material of a more durable character, making the mat not only more lasting, but more ornamental as well.

It will be evident that in a bank, or other place where the floor is much trodden upon by people going in and out, carrying water and mud with them on their feet, and dripping umbrellas in their hands, ordinary floor mats become soaked, and hollows in the floor filled with water, making it very unpleasant. The application of this flooring obviates this, alike in preventing the wear or in covering the hollows of a worn floor.

HARDENING STEEL TIRE FLANGES.

An English journal gives an account of an Austrian furnace for partially hardening the steel tires of locomotive wheels. Although we do not build many locomotives on this coast, the arrangement may have other adaptations. A condensed description of the process is given in the *Iron Age* as follows: The furnace has a small, square, central grate, above which the section of the furnace is circular. The wheel with the tire on it is placed on a projecting ring of the furnace, and the nuts of the tire bolts are slacked to allow the tire to expand from the wheel when heated. The annular space around the tire is then packed with coke in a state of ignition, and blast coming from a large number of nozzles attached to a circular blast pipe is directed at the root of the flange of the tire under treatment. In order to insure uniform heating, the wheel is turned around from time to time. When the flange of the tire which is thinner and therefore heats more rapidly, has become dull red, the wheel is lifted from the furnace and the heated tire is plunged into water of 60° to 70° Fahr. As a fragment shown by the Oravitza-Anima railroad at Paris proves, this process hardens the steel to a depth of from 0.08 to 0.12 inch, especially near the root of the flange. The heating process, which must be rapid to insure its being local, requires only from six to seven minutes. The inner part of the tire must be kept cool by a covering of old cotton waste constantly moistened. It is stated that tires so treated last twice as long as ordinary ones.

THOMAS' STEAM WHEEL.

The accompanying engravings, with the following description, will sufficiently explain to all, but especially to our mechanical readers, the advantages which the inventor claims for this machine over the ordinary rotary and reciprocating engines, to wit:

"Fig. 1 is an exterior perspective view, and from Fig. 2 the working parts will be understood. The wheel, the shaft of which rotates in bearings in the case, has ring flanges on the edges of its face, making a wide and deep channel thereon. Six or more arms connect the rim to the hub, midway between which and on the face of the wheel are formed deep transverse recesses, in which work the radial pistons *A*. To the inner edge of each piston are attached two or more rods *B*, which pass through stuffing-boxes, so as to prevent any steam from leaking around them into the interior of the wheel. These rods are secured to boxes in which are placed bars *C*, said bars being held out by springs. As the bars pass through slots in the ends of the boxes, the pistons are thus allowed a little play, while the springs also serve to hold them against packing, noted further on. At *D* are radial bars attached to the rim and the hub of the wheel. In guide-slots in these the ends of the bars *D* enter, and they also pass through holes in the long arms of levers *E*, which are pivoted to the wheel arms. To the short arms of said levers are pivoted bars *F*, which slide in keepers on the wheel-rim, and have pins on their ends. These pins carry friction-rollers which move in guide-slots *G*, in the sides of the case. The object of the jogs in said slots is to throw the pistons *A* out to receive steam, and to draw them in at the exhaust ports.

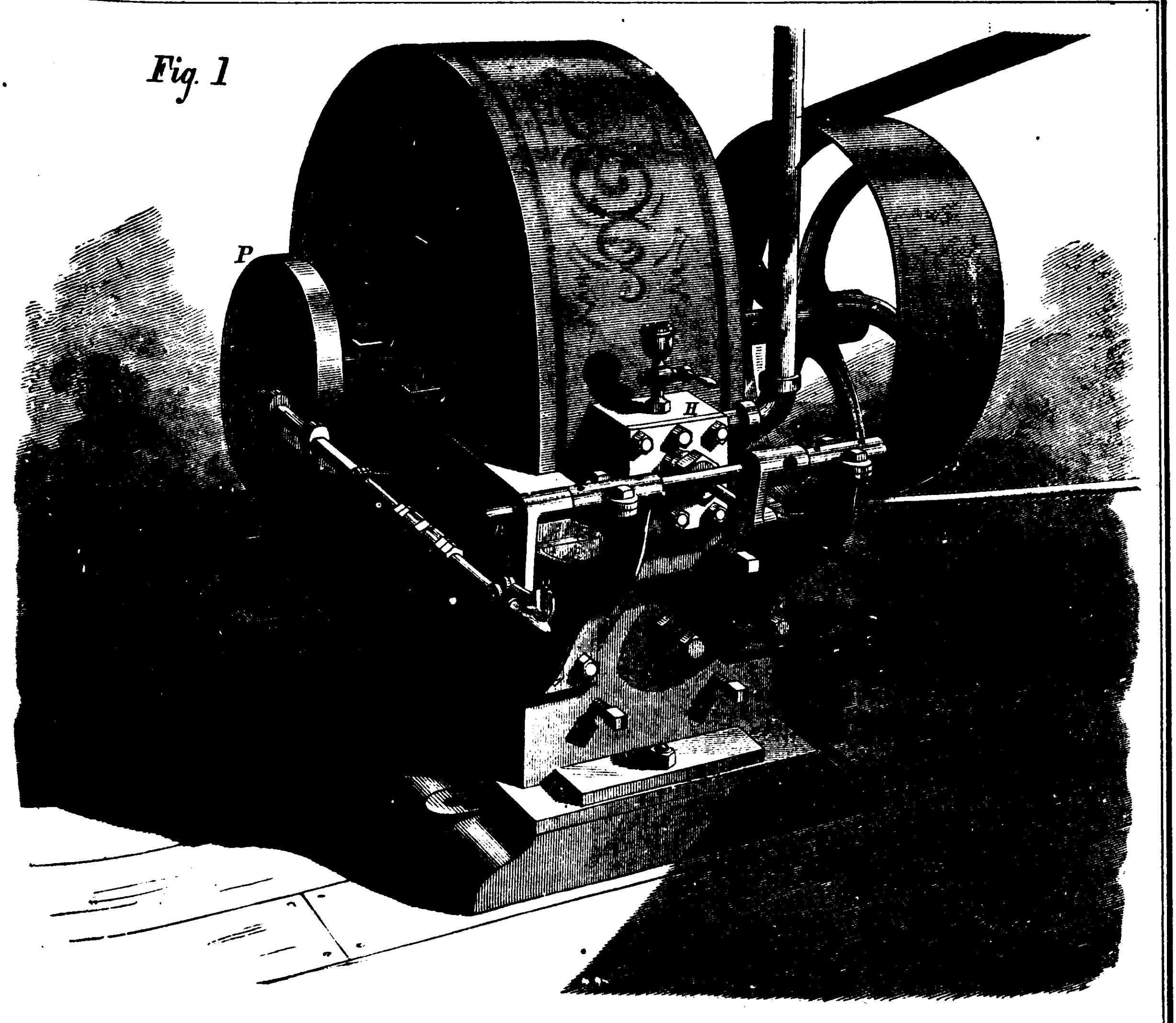
"Fig. 1 is the steam-chest, resting upon the upper edge of the case and fastened to packing I, Fig. 2, which is curved upon the arc of the circumference of the wheel, and has abutments *J* to fit into the space between the rim flanges. These abutments are beveled as shewn, and are provided with brasses held out against the rim by springs. The brasses have arms which, in similar manner, are pressed against the inner side of the wheel-flanges. They are also so constructed that they may be expanded and contracted longitudinally to allow of nice adjustment to the wheel. On their inner side a plate is provided, acted on by springs to prevent steam from passing between their parts when they are expanded. The packing *I* rests on a concaved block *K*, which may be moved forward and back by the screw *L*; it may be adjusted so as to cause the packing to bear squarely against the face of the wheel, by four set-screws. The block is held down by flanges, one of which enters a keeper in the case, and the other passes out through an aperture in the end of the same. The latter flange is slotted to receive a screw for further securing.

"The entrance of steam through the inlet port is regulated by the valve *N*, the stem of which is pivoted to an arm on the rock-shaft B, Fig. 1. A crank-arm on this shaft receives a notch on the connecting rod, which is guided in a bracket on the case. A pin on the rod enters a groove in the side of wheel *P*. This groove has as many offsets as there are pistons *A*, and these are in such positions as to operate the valve to admit steam as each piston passes the inlet port, the length of the curve regulating the length of time in which the valve is held open.

"By suitable construction, the connecting rod may be regulated to govern the throw of the valve; and by engaging the hook *Q*, on the protruding end of the shaft above, the notch in the rod is raised from the crank, so that the valve may be operated to start the wheel regardless of the position of the same. The hole shown in the rock-shaft is for a hand-lever, so that the valve may be operated by hand for starting the wheel.

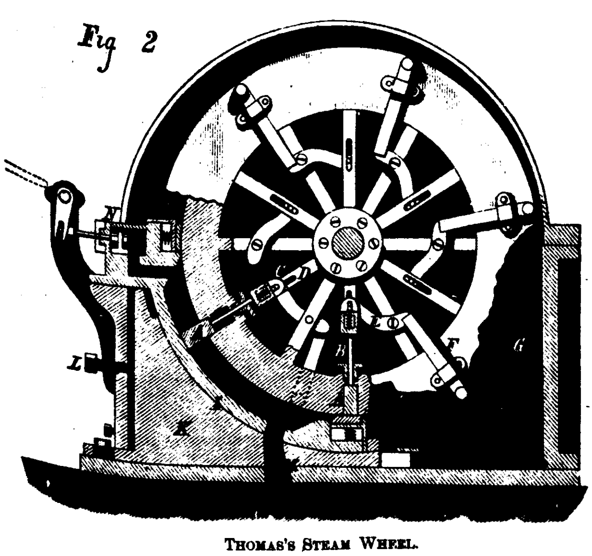
"The advantage of working steam directly on the periphery of the wheel and its use expansively from boiler pressure down to any point desired, at the same time working on the same leverage and to same mechanical advantage on all points of the circle. The 'wheel' does not require to be cased up steam-tight all around, as the steam is applied only to one piston at a time, and it is intended to run so that the pistons will travel the same number of feet per minute as the piston in the reciprocating engine. Hence the friction is reduced to a minimum and the durability increased to the maximum. The machine is simple in construction, requires but little room, will start off freely and easily at all points, is easily managed, and can be built for less money than the ordinary engine. Unlike the reciprocating engine, it is free from all liability to such accidents as the bursting out of cylinder-heads, breaking of crank-pins, connecting rods, &c., and last, but not least, it will effect a great saving in fuel. — *Polytechnic Review.*

Fig. 1



THOMAS' STEAM WHEEL.

Fig 2



THOMAS'S STEAM WHEEL.

DANGER IN USE OF TANKS FOR DRINKING WATER.—A friend raises the question whether there is really any serious objection to using the water from household tanks for drinking and culinary purposes. If the tank is frequently cleaned and is protected from the access of sewer-gas and other contaminations, aqueduct or rain-water will not suffer from being temporarily kept in it; but since in nine cases out of ten the danger of contaminations will *not* be sufficiently guarded against, the discreet householder will make it a rule not to use the water from the tanks for drinking if it can possibly be avoided. Analysis has sometimes shown a considerable degree of contamination in water, even when the tank, supplied by an aqueduct, had been cleaned a week before; and in no case should a tank be allowed to go uncleaned for more than three months. The water as it flows through the aqueduct pipes carries more or less impure matter along with it, which settles to the bottom of the tank. The amount may not be sufficient to affect seriously the quality of the water as drawn directly from the pipes, but its accumulation in the tank may be injurious if not dangerous. Then, again, if the tank is used to supply a water-closet, or if the overflow, as is often the case, communicates directly with a soil-pipe, the water may be contaminated in that way. This has happened in more than one instance reported by sanitary authorities, and probably in thousands of instances not reported nor suspected. The chief use of a tank where the water supply is by aqueduct is to prevent trouble with hot-water apparatus if the supply is temporarily cut off; but it is rarely the case that such interruption continues so long as to render it necessary to use the water from the tank for culinary purposes. At any rate, it should be thus used only in cases of absolute necessity.—*Boston Journal of Chemistry.*

Mechanics.

THE PHILOSOPHY OF WELDING.

Alexander L. Holley recently read a very interesting paper before the Philadelphia Institute of Mining Engineers, from which we give the following extracts: The generally received theory of welding is that it is merely pressing the molecules of metal into contact, or rather in such proximity as they have in the other parts of the bar. Up to this point there can hardly be any difference of opinion, but here uncertainty begins. What impairs or prevents welding? Is it merely the interposition of foreign substances between the molecules of iron, or of iron and any other substance which will enter into molecular relations or vibrations with iron? Is it merely the mechanical preventing of contact between molecules, by the interposition of such substances? This theory is based on such facts as the following:

1. Not only iron but steel has been so perfectly united that the seam could not be discovered, and the strength was as great as it was at any point, by accurately planing and thoroughly smoothing and cleaning the surfaces, binding the two pieces together, subjecting them to a welding heat, and pressing them together by a very few hammer blows. But when a thin film of oxide of iron was placed between similar smooth surfaces, a weld could not be effected.

2. Heterogeneous steel scrap, having a much larger variation in composition than these irons have, when placed in a box composed of wrought-iron side and end pieces laid together, is (on a commercial scale) heated to the high temperature which the wrought-iron will stand, and then rolled into bars which are more homogeneous than ordinary wrought-iron. The wrought-iron box so settles together as the heat increases, that it nearly excludes the oxidizing atmosphere of the furnace, and no film of oxide of iron is interposed between the surfaces. At the same time the enclosed and more fusible steel is partially melted, so that the impurities are partly forced out and partly diffused throughout the mass by the rolling.

The other theory is, that the molecular motions of the iron are changed by the presence of certain impurities, such as copper and carbon, in such a manner that welding cannot occur or is greatly impaired. In favor of this theory it may be claimed that say 2% of copper will almost prevent a weld, while, if the interposition theory were true, this copper could only weaken the weld 2%, as it could only cover 2% of the surfaces of the molecules to be united. It is also stated that 1% of carbon greatly impairs welding power, while the mere interposition of carbon should only reduce it 1%. On the other hand it may be claimed that in the perfect welding due to the fusion of cast-iron, the interposition of 10% or even 20% of impurities, such as carbon, silicon and copper, does not affect the strength of the mass as much as 1% or 2% of carbon or copper affects the strength of a weld made at a plastic instead of a fluid heat. It is also true that high tool steel, containing 1½% of carbon, is much stronger throughout its mass, all of which has been welded by fusion, than it would be if it had less carbon. Hence copper and carbon cannot impair the welding power of iron in any greater degree than by their interposition, provided the welding has the benefit of that perfect mobility which is due to the fusion. The similar effect of partial fusion of steel in a wrought-iron box has already been mentioned. The inference is, that imperfect welding is not the result of a change in the molecular motion due to impurities, but of imperfect mobility of the mass—of not giving the molecular a chance to get together.

Should it be suggested that the temperature of fusion, as compared with that of plasticity, may so change the chemical affinities as to account for the different degrees of welding power, it may be answered that the temperature of fusion in one kind of iron is lower than that of plasticity in another, and that as the welding and melting points of iron are largely due to the carbon they contain, such an impurity as copper, for instance, ought, on this theory, to impair welding in some cases and not to affect it in others.

The obvious conclusions are: 1st. That any wrought-iron of whatever ordinary composition, may be welded to itself in an oxidizing atmosphere at a certain temperature, which may differ very largely from that one which is vaguely known as "a welding heat." 2nd. That in a non-oxidizing atmosphere heterogeneous irons, however impure, may be soundly welded at indefinitely high temperatures.

The next inferences would be that by increasing temperature we chiefly improve the quality of welding. If temperature is increased to fusion, welding is practically perfect; if to plasticity and mobility of surfaces, welding should be nearly perfect. Then how does it sometimes occur that the more irons are heated the worse they weld?

1. Not by reason of mere temperature, for a heat almost to dissociation will fuse wrought-iron into a homogeneous mass.

2. Probably by reason of oxidation, which, in a smith's fire especially, necessarily increases as the temperature increases. Even in a gas furnace a very hot flame is usually an oxidizing flame. The oxide of iron forms a dividing film between the surfaces to be joined, while the slight interposition of the same oxide, when diffused throughout the mass by fusion or partial fusion, hardly affects welding. It is true that the contained slag, or the artificial flux, becomes more fluid as the temperature rises, and thus tends to wash away the oxide from the surfaces; but inasmuch as any iron with any welding flux can be oxidized till it scintilates, the value of a high heat in liquifying the slag is more than balanced by its damage in burning the iron.

3. But it still remains to be explained why some irons weld at a higher temperature than others, notably, white irons high in carbon, or in some other impurities, can only be welded soundly by ordinary processes at low heats. It can only be said that these impurities, as far as we are aware, increase the fusibility of iron, and that in an oxidizing flame oxidation becomes more excessive as the point of fusion approaches. Welding demands a certain condition of plasticity of surface; if this condition is not reached, welding fails for want of contact due to mobility; if it is exceeded, welding fails for want of contact due to excessive oxidation. The temperature of this certain condition of plasticity varies with all the different compositions of irons. Hence, while it may be true that heterogeneous irons, which have different welding point, can not be soundly welded to one another in an oxidizing flame, it is not yet proved nor is it probable that homogeneous irons can not be welded together, whatever their composition, even in an oxidizing flame. A collateral proof of this is, that one smith can weld irons and steels which another smith can not weld at all, by means of a skilful selection of fluxes and a nice variation of temperatures.

COMPRESSION BY STEAM IN CASTING.—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 urged, 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 cannons 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.

POLISHING BRASS.—The following reply to a question is given in the *English Mechanic*: The final polish is obtained by burnishing with steel burnishers, after which the articles are heated in a stove, and the lacquer applied with a camel's hair brush. If the temperature is too cold a dullness of surface is produced, which is not removed by re-heating. I have sent a recipe or two for the lacquer, if you like to make your own, which must be warmed as well as the articles;—For a good gold coloured lacquer, take seed-lac (unbleached), 3 oz.; turmeric powder, 1 oz.; dragon's blood, ¼ oz.; methylated spirits of wine, 1 pint. Bruise the lac and dragon's blood before mixing them in the spirit, and let it remain for some days, shaking it frequently; afterwards drain off the liquor, or, if necessary, filter it. Ingredients for a brass lacquer: Shellac, 8 oz.; sandarac, 2 oz.; annotto, 2 oz.; dragon's blood resin, 1 oz.

THE CARE OF SHOP TOOLS.

The *American Machinist* has some important suggestions concerning the advantage of care and system in the treatment of shop tools. First cost of tools seldom represents their ultimate cost, whether it becomes necessary to repair them or not. If a good mechanic makes a tool last a year in constant usage, while his careless neighbor uses up one of the same kind in six months, the cost of the latter should be accounted twice that of the former. When repairs are made their value must be added in computing the whole cost of the tool.

One primary reason why some shops can show a greater profit on a given amount of work is because they get more service out of their tools. This is just as evident when the tools are cheap as when they are dear, for the products of mechanical labor fluctuate the same as the first cost of tools; and if a large part of the income of the business goes for working tools and repairs to the same, balances on the right side of the ledger are likely to be diminutive, if indeed they appear at all. It is the first requisite that tools and machine should be adapted to the work to be performed. Fine tools should not be used on heavy, coarse work. They must also be kept in good working order, cutting edges well sharpened and bearing surfaces lubricated, shafting kept well aligned, pulleys balanced, belts kept clean and pliable and at the correct tension, rust prevented, emery wheels trued up, and dirt kept out of all wearing parts.

Machines should be mounted on stable foundations and run neither above nor below the proper speed required to do the work. Small tools require as much as large ones, and a careless or inexperienced workman will often spoil more than the amount of his wages in files, drills, chucks, reamers, taps, dies, calipers, wrenches and the like, unless closely looked after by the master mechanic. It is therefore very essential, in order to insure proper care of tools, that workmen know just how to use them. All small tools should be laid away systematically in a dry place, when not in use. In large shops a room should be set apart for this purpose, and a man detailed to take charge of it and keep the tools in good working order. There is no part of a large machine shop from which an outsider can form a better judgment of the general management than by an observation of the tool room. The best economy is secured by securing none but the best tools at the outset, for in the long run they will be found the cheapest.

SOLIDITY IN IRON CASTING.

Great difficulty is experienced in the ordinary way of casting to get a uniformity in the mass and any near approach to perfect solidity. For some years past the difficulty has been obviated to a more or less extent by mechanical pressure. The possibility of doing this was very fully shown at the recent Paris Exposition, by Mr. Whitworth, of Manchester, England, whose exhibit comprised an excellent collection of compact pressed castings, which, when compared with the unpressed ingots shown alongside, gave striking tendency of the utility and effect of mechanical compression in iron casting.

Since the introduction of mechanical pressure in casting, however, it has been discovered that a much better result in the same direction may be more readily obtained by chemical action. This chemical action consists in the deoxidizing action of manganese, silicon, &c., in the mass of the iron while in its molten state. This new process has quite recently been brought to an astonishing degree of perfection. This was fully shown, at the Paris Exposition, by the French Terrenoire Company, and by other exhibits, both French and English. These exhibits proved most conclusively that compact castings, containing but small amounts of carbon, can be produced on a scale and to a degree of perfection hitherto unthought of, simply by a skilful use of deoxidants. Not only manganese and silicon can be successfully used, but tungsten and chromium can be employed to the same end.

Silicon has been found to be by far the most effective of these reagents; but it is accompanied with the disadvantage, that, when used in excess, it is more harmful to the quality of steel than that of either of the other substances used for producing the desired hardening results. For this reason manganese is preferred and used in the form of ferro-manganese, or ferro-manganous silicide. Hitherto there has been much difficulty in obtaining such alloys; but at the present time these alloys can be produced in any desirable proportion up to 87 p. c. of manganese, a thing which, two years ago, was considered an utter impossibility. In addition to the value of this process of oxidation as a means for obtaining solid, compound castings, these same alloys are also employed for the purpose of deoxidizing mild steel, which can thus be brought down to any desirable degree of poverty in carbon, say, to five one-hundredths of a per cent. As already intimated, the technical progress which has placed this process within the range of ready practicability, is the discovery by which the compounds needed may be produced at a sufficiently cheap rate.

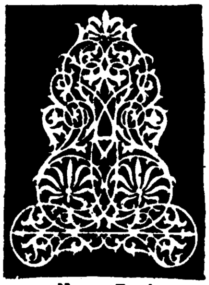
A NEW TEST FOR STEEL.

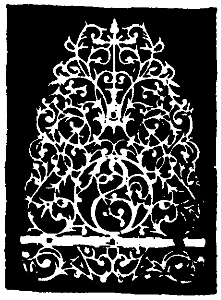
Although the mechanical and practical tests employed to ascertain the quality of steel undoubtedly offer the basis for a good estimate of the material, and valid conclusions may in many cases be drawn as to homogeneity from the appearance of the fracture, serious mistakes may be made in the latter course, because even close steely fracture cannot always be relied upon; nor is the fact that in manufacture the steel has passed through a liquid condition, a guarantee for its homogeneity. The question is, whether the particles of steel which in a state of rest are uniformly grouped, are so also when the material is subjected to stress. The molecular changes to which fibrous iron is subject under long continued vibrations or concussions, are well known, and it is established that similar changes of structure, caused by molecular movement, occur with steel also, though not so frequently. The result of long-continued vibration of iron and steel is a gradual decrease of cohesion. A means for ascertaining the degree of such a molecular change and its consequences, would naturally possess great practical importance.

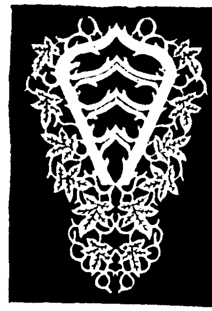
Prof. Anton von Kerpely has recently read before the Hungarian Academy of Sciences, an important and interesting paper, in which he claims to have elaborated a simple means for attaining the desired end, a claim which he substantiates by the publication of the reproductions of a series of fractures of various grades of steel, obtained by widely differing processes of manufacture and under widely differing circumstances. His test consists of fracturing the sample when hot, and, in order to secure a uniform temperature below red, he has chosen the dark blue color as an indicator. The following is his method in carrying out this plan of fracturing when hot. The sample to be examined is placed in a bath of lead, which is kept at low temperature in a graphite crucible. After 15 to 20 minutes, according to the thickness of the rod, it assumes the temperature of the bath. If a notch has not been made at the place where the fracture is to be effected, it can be easily done when the rod is hot. With a bath of low temperature the rod cools down too much by being placed on the anvil; in such a case it must be returned to the bath.

The best way to determine whether the sample rod has reached the proper color temperature, is to polish a portion with a file and notice the color of the brightened surface. If no color appears, or the blue disappears rapidly, the rod is too hot; but if any other color but blue remains constant for some time, the rod is too cold. As soon as the proper temperature has been struck the fracture must be made. Prof. Kerpely has made a long series of tests with steels from various processes of manufacture. His general conclusions from these are the following: Good crucible steel shows a peculiar behavior. Molecular change, though plainly discernible by the fine scaly structure, is trifling only when compared to results obtained with other grades. The fracture is almost smooth, and homogeneity seems to have been impaired but little, and it is only with the softest kinds of cast steel that the structure becomes somewhat more scaly in character. Bessemer steel of middling hardness showed quite a high degree of disturbance of the molecular structure, having a coarsely and deeply furrowed fracture, bearing some resemblance to wrought iron. Although it does not follow that all Bessemer steel will exhibit such characteristics, Prof. Kerpely believes that the fracture of the steel may be relied upon, in most cases, as an indicator in tracing the origin of a steel, and often in permitting conclusions as to the treatment it has undergone. The subject is one which certainly deserves experimental inquiry at the hands of American metallurgists and steel manufacturers. —*Iron Age.*

UNSLAKED LIME FOR BLASTING PURPOSES.—Unslaked lime compressed into cartridges, or used loosely and well tamped down in the hole, using water or other liquid to saturate and expand it, is now proposed for blasting in fiery coal mines. It is claimed that the advantages to be derived from its use are economy in the production of coal; making less slack than by using ordinary blasting powder; lives of colliers are in less danger; the breaking and shattering of coal back of the charge —which is especially characteristic of the use of gunpowder—is avoided; and the quality of the atmosphere is rather improved by its use than otherwise.

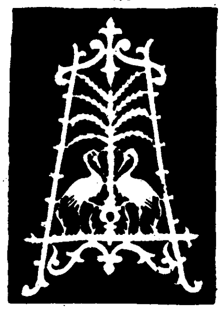

No. 11. Easel.
Price 10 Cents.
Size 8 x 11 in.


No. 12. Easel.
Price 10 Cents.
Size 7 x 9½ in.


No. 13. Holder for Grass Bouquets (carved). *Price 10 Cents.*
Size 5 x 8 in.


No. 14. Match Box.
Price 5 Cents.
Size 6 x 9 in.


No. 15. Corner Bracket or Book Shelf. *Price 10 Cents.*
Size 6 x 18 in.

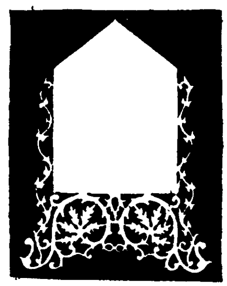

No. 16. Easel.
Price 5 Cents.
Size 7 x 10 in.

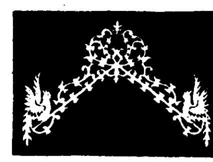

No. 17. Picture Frame (carved).
Price 10 Cents.
Size 8 by 11 in.

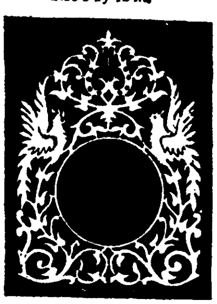

No. 18. Side to Hanging Basket. *Price 10 Cents.*
Size 5 x 5½ in.

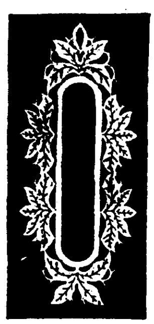

No. 19. Corner Cabinet, Bracket Support. *Price 25 Cents.*
Size 8 by 10 in.


Corner Cabinet. Top Frame for No. 19.
Size 8 by 10 in.

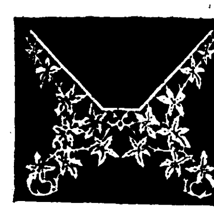

No. 20. Swiss Clock.
Price 15 Cents.
Size 8½ x 11 in.

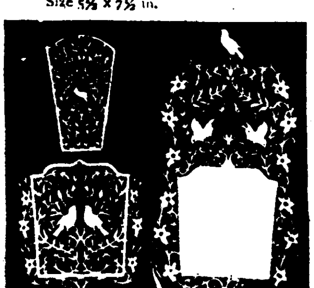

Top to Clock, No. 20.

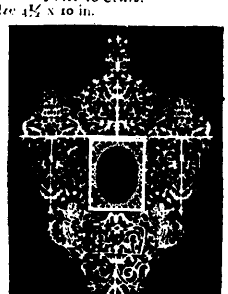

Front for Clock, No. 20.
Size 5½ x 7½ in.

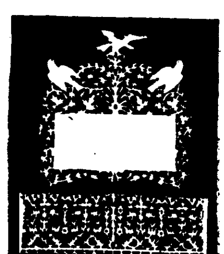

No. 21. Thermometer Frame.
Price 10 Cents.
Size 4½ x 10 in.


No. 22. Small Wall Pocket.
Price 10 Cents.
Size 7½ x 8½ in.


Stand for No. 10.

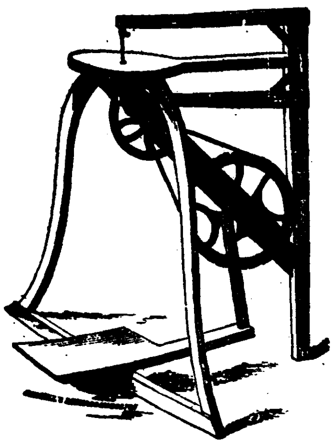

No. 23. Wall Pocket.
Price 15 Cents.
Size 9 x 16 in.

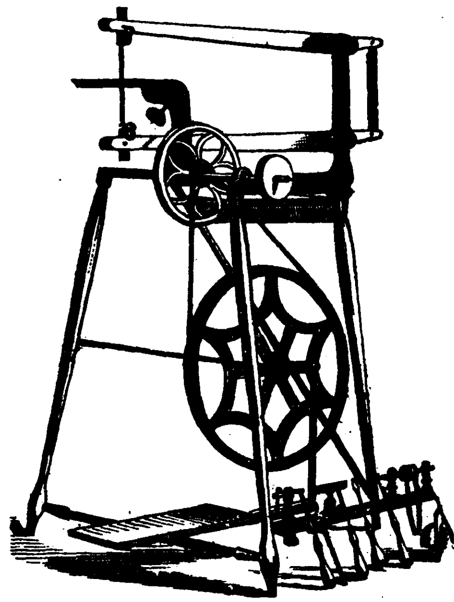

No. 24. Combined Bracket, Picture Frame, and Match Box. 15 *Cents.*
Size 11 x 15 in.

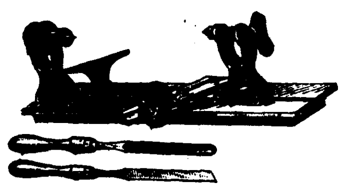

No. 25. Small Wall Pocket.
Price 10 Cents.
Size 8 x [illegible] in.


No. 26. Large Wall Pocket.
Price 15 Cents.
Size 12 x 14 in.

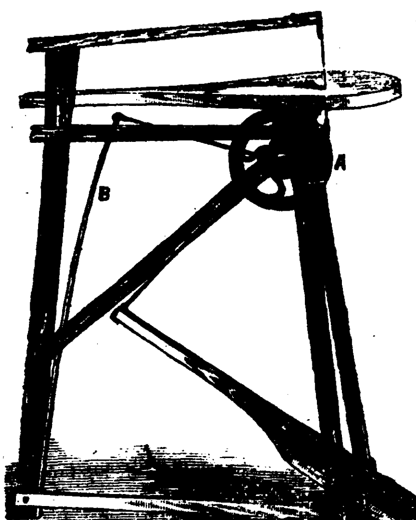
HOME AMUSEMENTS.—Designs by G. Webster Peck, New York.

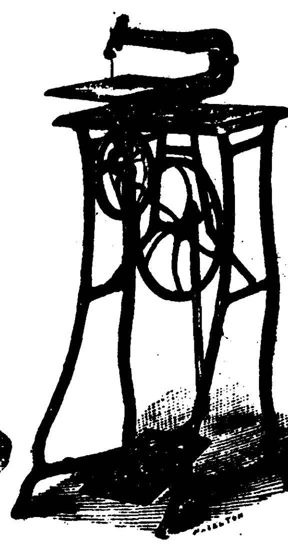


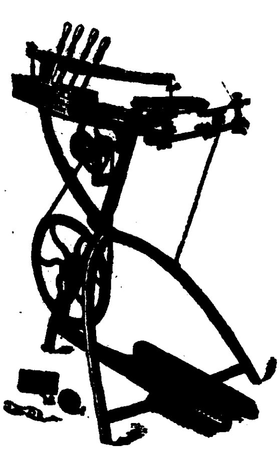




Drill for No. 2 Saw.







Inlaying Attachment

Home Amusements.

FRET SAWS AND DESIGNS.

At the request of several of our subscribers, we give several illustrations of fret saws, and also some beautiful designs for various ornamental household articles in fret work—for which we are indebted to Mr. G. Webster Peck, Manufacturers' Agent, 110 Chambers Street, New York. If our young people would only give more of their leisure hours to pleasant, useful recreations at home, in any form, there would be far less inclination on the boys' part to fritter it away, as is so often done by them, in frivolous sport, and too often in sinful ways. If every father gave encouragement to his sons to spend their leisure hours in amateur mechanics, and afforded to them the necessary tools and space in the house to do such work in, without considering it a bore to his comfort or a nuisance in the house, there would be far less erring souls in the world.

Chemistry, Physics, Technology.

WOOD PULP FOR PAPER.

The scarcity of paper material has of late years led to quite a large employment of wood pulp as a mixture with other fibers in the manufacture of paper. Experience, however, is beginning to show that this addition to the usual paper stock is very prejudicial to the lasting quality of the material. Prof. Rouleaux recently called attention to the subject in a lecture delivered at Leipsic, pointing out that, as the paper used in the German public offices is mainly composed of wood, the destruction from natural causes, of any important official records, may be expected. He limits their duration to about 15 years.

This reference is to writing paper, in which but a small quantity of wood is used. How much greater must be the loss and inconvenience in the case of printed books, into which a very large proportion of wood enters. According to Prof. Rouleaux's authority, all our libraries, if made up of paper so adulterated, will have to be renewed every 15 or 20 years, instead of lasting for hundreds of years, as is the case with paper made from the usual fibers.

ACTION OF IRON, COD-LIVER OIL, AND ARSENIC IN THE BLOOD.

Drs. E. S. Cutter and E. H. Bradford, of Boston, in an article in the *American Journal of Medical Sciences*, state that they have arrived at the following conclusions as to the effect upon the blood produced by administration of these drugs, both in health and disease:

1. In health, iron causes no increase in the number of the red corpuscles; but in the pathological state called anæmia there is an increase in the number of the red corpuscles under its use.

2. In the healthy subject, cod-liver oil causes an increase in the number of the red corpuscles, and a slight increase in the white. In certain pathological conditions this seems to be also the case if the medicine is well borne. If, however, the morbid process is active and the appetite is disturbed, the medicine does not appear to check the consequent anæmia.

3. Liquor potassæ arsenitis given in health caused a progressive decrease in the number of the red and the white corpuscles, that of the latter being most marked. In severe anæmia, on the contrary, there seems to be an increase at first of both red and white corpuscles. After a certain point there is a steady diminution of both, however. In the case of leucocythæmia there was a decrease in both red and white corpuscles, the decrease of the latter being very marked.

IS SEWER GAS INFLAMMABLE?

I find the following items in a Scotch journal:

"On Dec. 26, a house at Laigh, Carlside, Johnstone, belonging to Mr. Urquhart, was seriously damaged by an explosion of gas which had accumulated in the sewage pipes, and which had escaped from the main on the streets."

I have met many experienced men who deny utterly that sewer gas is ever of such a nature as to be ignitable. That it will burn, I know to be a fact; some eight or ten years since while in the employment of R. & A. Scrimgeour, I was sent to make some repairs in the house of Mr. Townsend, Bayridge, Fort Hamilton Road, and finding it necessary to remove the trap under the sink, (S'S) I cut it right off above the flange, when the gas caught fire from the candle and a solid flame, bluish gray in color, shot up striking the bottom of the sink. I easily extinguished it by placing my hat over the mouth of the pipe. Mrs. Townsend, if still living in the same place, will corroborate this statement as she stood by and saw the whole thing.

J. S.

THE LIGHT FROM VENUS AND MERCURY.—Quite a singular and most unexpected discovery was made at the near approach of these two planets in September last, by Mr. James Nasmyth, an English astronomer. It remains to be seen whether photography or spectrum analysis will some day give us the key to the enigma. The fact was then first distinctly observed that there is a great difference between the degrees of brilliancy emitted by these two planets; and, that while Mercury being much nearer the sun should be more brilliant, just the contrary happens, for Venus shines with the greater luster. On the 26th and 27th of September these two stars were near enough to be embraced within the field of the lens at the same time, and Mr. Nasmyth was thus enabled to compare the brilliancy of Venus to polished silver, and that of Mercury to lead or zinc. The reason of this difference, which is theoretically exactly contrary to what we should expect, is at present unexplainable.

A NEW SOURCE OF LEAD POISONING has been found in Germany in the covering employed for children's carriages. The danger has been confirmed by the occurrence of numerous cases of child sickness among those who have been carried about in the little vehicles that are covered with this cloth, the symptoms being invariably those of lead poisoning. An investigation was recently undertaken at the instance of the Imperial Health Office, and in the different specimens of such cloth, both of German and foreign make, the enormous quantity of 45·7 per cent of metallic lead was found. From a piece of cloth weighing 10 grams a mass of lead weighing 4·25 grams could be obtained. The fabric burned readily, and drops of lead reduced to the metallic form could be seen running off, even when only a small piece of it was ignited.—*Journal of Materia Medica.*

BLEACHING FEATHERS, ETC.—The *Moniteur Industriel* states that Messrs. Viol and Duplot have recently devised a method of bleaching feathers, which, if successful, will be welcome to many who have been unable to get at the carefully-guarded secret methods used hitherto. Their method rests on the fact that feathers immersed in resinous essences (such as turpentines and other carbureted oils from distillation of resinous juices in general, or in like oils in lavender, thyme, etc., or in bituminous hydrocarbons) are decolorated under the action of light and heat. The feathers, especially ostrich plumes, are kept in the vessels a longer or shorter time, according to the degree of bleaching wished, and at about 80° F., while exposed to light as much as possible. In three or four weeks they are dried and prepared according to known methods.

TOAD POISONING.—The following singular account of the action of toad poisoning on the human body, is reported in the last number of the London *Chemist;*

A child of six years old followed a large toad on a hot summer's day, throwing stones at it. Suddenly he felt that the animal had spurted some moisture into his eye. There suddenly set in a slight pain and spasmodic twitching of the slightly injected eye, but two hours after, a jumping sight, desire to bite, a dread of food and drink, constipation, abundant urine, great agitation manifested themselves, followed on the sixth day by sickness, apathy, and a kind of stupor, but with a regular pulse. Some days later, having become comparatively quiet, the boy left his bed; his eyes are injected, the skin dry, the pulse free from fever. He howls and behaves himself like a madman, sinks into imbecility and speechlessness, from which condition he never rallies.

A NEW METHOD OF DETERMINING THE HEAT VALUE OF FUEL.—With regard to the important question of the heat value of fuel, it has been proved that conclusions from the results of elementary analysis are very uncertain, and, also, that little reliance can be placed on direct evaporization experiments. In a recent paper in *Die Chemische Industrie*, Dr. Weyl points out the faults of these methods, and recommends, as preferable, decomposition of the fuel by dry distillation and analytical determination of the solid, liquid, and gaseous products of decomposition. In this method the accident of too small a sample being used is avoided, as also too great pulverization and drying at high temperature and the decomposing action of atmospheric oxygen, which is therewith connected, and the whole of the coke is weighed, and its carbon, hydrogen, and mineral constituents determined. The water, tar, and gas that are formed are measured and their heat of combustion ascertained with the aid of data, that have been supplied by Favre and Silbermann and Deville. The final result will, of course, exceed the true combustion value of the coal by the amount of heat equivalent to the work of decomposition into coke, tar, and gas. The decomposition of the coal should be done as quickly as possible, and at a high temperature.—*Mining and Scientific Press.*

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

Notes and Clippings.

The Electric Light Dangerous.—Mr. J. M. Stearnes, Jr., of Brooklyn, points out a novel source of danger possible with the electric light, namely, its effect upon the nervous system. He says: "The very high penetrating power of light waves from incandescent metal of carbon heated by electricity is well-known. It is so high, indeed, that the shadows cast by the light are blacker than Erebus, indicating an immense absorption of force by the intervening objects, and to a large extent destroying their reflection and diffusion, as is the case with lights of lesser tension. A reflector used with an electric or calcium light does not produce anything like a corresponding effect as when used with a common gas flame, as persons familiar with calcium lights well know. And it follows, therefore, that the black shadows of the electric flame must be due to the absorption of light waves. Now, in the light of an electric arc or incandescent lamp, one is to be subjected to a very powerful stimulant from the mere obstruction which his body affords. Our eyes cannot bear it all, and there is no reason to doubt that every nervous tissue will feel its use. We have already in this climate enough of nervous stimulation, and a fearful catalogue of nervous diseases, arising from too much force."

Liquefaction of Oxygen. — M. Raoul Pictet concludes an article on the liquefaction of oxygen with the remark that his investigations necessitated an unusually large number of experiments for the establishing of preliminary data, and these he obtained by the aid of the Geneva Society for the construction of Physical Instruments, who furnished him with apparatus worth 50,000 francs, and thereby enabled him to work out results with perfect accuracy. He recommends that similar apparatus should be provided in all laboratories as an "essential means for the study of the molecular forces. Who knows," he asks, "but what crystallization and certain reactions may thereby be placed in peculiarly favorable conditions for further investigation?"

Electrical Telegraphing without Wires.—Prof. Loomis continues his experiments in the mountains of West Virginia, to demonstrate his theory that at certain elevations there is a natural electric current, by taking advantage of which telegraphic messages may be sent without the use of wire. It is said that he has telegraphed as far as eleven miles by means of kites flown with copper wire. When the kites reached the same altitude, or got into the same current, communication by means of an instrument similar to the Morse instrument was easy, but ceased as soon as one of the kites was lowered. He has built towers on two hills about 20 miles apart, and from the tops of them has run steel rods into the region of the electric current.

Electric-Spark Pen.—A new invention in the art of engraving, probably suggested by the familiar electric pen, has been brought out in Paris. A copper plate is prepared as for engraving, and over this is secured, in some convenient manner, a thin sheet of paper. The plate is then connected with one pole of a Ruhmkorff coil. The pen (presumably a simple insulated metallic rod or pencil with a fine point) is also connected, by means of an insulated wire, with the coil. Then, if the point of the pen (which is bare) is touched to the paper, a minute hole is burned in it by the spark that leaps from the point of the pen to the plate. By using the pen as a pencil, a drawing may be made on the paper in a series of fine holes precisely after the manner of the electric pen, except that in one case the holes are mechanically punched out, and in the other case are burned out. When the drawing is finished, the paper may be used as a stencil. A printer's roller carrying an oily ink is passed over the paper, and the ink penetrating the paper through the holes, reproduces the drawing in ink on the copper plate. The paper may then be removed and the plate submitted to an acid bath, when the surface will be cut away, except where the ink resists the acid, and those parts will be in relief, thus producing an engraved plate ready for the printing-press. By this ingenious device, the artist, drawing upon the paper with the spark-giving pen, performs two operations at once—drawing the picture and engraving the plate.

Rats.—A novel way of destroying rats is mentioned in the *English Mechanic*, adopted by a provision merchant in Limerick, which he showed to me some 30 years since, and which he called his "rat barrack." He estimated his loss by rats eating and damaging his goods at fully £200 per annum, and this I am quite prepared to believe as his average of pig killing in season time was a thousand, or perhaps nearer to two thousand per week, besides an extensive tannery and leather store. He had tried almost every known method of destroying them—traps, poison, cats, dogs and even foxes; but all proving unavailing, he thought he would try what kindness would do! So in the middle of a lumber-yard at the extreme end of his extensive premises he built his "barrack," say 15ft. long by 8ft. wide, and the walls 3½ft. high, good sound stone and mortar work, the top coped with flags projecting 12in. inside, so that a rat could not climb out; the building was covered with a boarded hipped roof, strongly made, and perfectly waterproof, the eaves projecting 6in. all round, and fitting snugly to the coping; the roof was moveable, but would take four men to lift it. At the base of the walls a hole the exact size of a brick was left in each side and end, and when finished all, inside and out, was well limewashed. He then had a quantity of pieces of timber, planks, &c., and the cleanest and best unbroken straw—*i e.*, hand-threshed such as is used for singeing pigs) placed inside, and outside the rats were duly supplied with food such as they liked best, especially the blade-bones of pig, and pans of clear water. So here the rats lived in great luxury and quietness, as the yard was not much frequented; but whenever a rat was heard of in any other part of the premises it was worried by the terriers, its best escape being to the before-named elysium, where its life would be one of extreme happiness—at least until the "day of doom" came round. Once a year or oftener Mr. Russell held his "rat battue." About one or two of an afternoon, when Mr. and Mrs. Rat, and their numerous descendants, were sure to be at home, he hunted up all the premises with his terriers, of which he had the best selection in the country, proceeding in the end to the lumber-yard, put a brick into each of the holes in the barrack walls, took off the roof, and with pitch-forks removed the planks, &c., from the inside, and put in the dogs. These soon gave the finishing shake to the poor inmates, who could not escape either by the holes or over the walls. At the battue previous to my visit I was assured they had killed sufficient to fill half a sugar hogshead! After the massacre and removal of the dead the place was thoroughly cleaned and fresh whitewashed with hot lime, and prepared with every comfort for a fresh immigration, for which there was an abundant supply in the neighbourhood.

To Polish Steel.—Mix half a pound of fine emery powder with the same quantity of soft soap, and add a small piece of soda. Simmer this over a slow fire for two hours, to extract all the moisture. Rub on with flannel, and finish with plenty of dry whiting.

Marking Tools by Etching.—Warm the steel and apply a thin coat of white wax, and let it thoroughly cool, then take a sharp engraver (a scratch awl will not answer) and run the point through the hair, in order that the point may be coated with the least possible amount of grease, and mark the device through the wax. Apply nitric acid and allow to stand for a few minutes, then wash off thoroughly with water, and heat the article; rub off the wax with a clean rag. By a little practise any one, who can form a shapely letter, will be able to mark a tool very nicely.

Labor-Saving Machinery.—The following, from Mr. W. Godwin Moody's indictment before the Social Science Convention at Cincinnati, embodies a popular error in regard to labor-saving machinery:

"It has so enormously developed the power of production as to far outstrip man's utmost power of consumption, enabling less than one half of the producing and working classes, working ten hours a day to produce vastly more than a market can be found for."

This starts upon the assumption that "man's utmost power of consumption" is fixed and known, and that all production in excess of that well-known limit must be surplus. Wiser men than Mr. Moody have reasoned from false premises to wrong conclusions. The "power of consumption" depends upon a great multitude of considerations. Our financial crisis, the natural result of our war and of the financial system it created has reduced the consumptive power of the people at least one half. We are growing back into a better condition. The consumptive capacity of the American people will, without doubt, increase at least fifty per cent during the next ten years, in addition to the increase which will come from an enlargement of our population. Almost every body is now living closely fearing for the future. Increasing crops, bringing money from abroad, and renewed activity in home industries will give increased purchasing ability. When affairs in this country reach their normal condition, it will be found that even with the labor-saving machinery there will be labor for all who are willing to work.—*Boston Commercial Bulletin.*

Machine Construction & Drawing.

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

(*Continued from page 92.*)

Figs. 75, 76, 77, represent the coupling adapted for a 3″ shaft, drawn to a scale of $\frac{1}{8}$.

34. One form of the *clutch* or *claw* coupling is shown in figs. 75*a*, 76*a*, 77*a*. This is a convenient form of coupling to use for shafting which is to be connected and disconnected at either long or short intervals, that is to say, it may be used as a permanent coupling or otherwise. If it is used as a permanent coupling there are two equal halves similar to B, one on each of the shafts *c* and *d*, each half being fixed to its shaft by a key. But if the coupling is to be connected and disconnected frequently, one half will be fixed, as B, to the shaft *d*, and the other half A will slide upon the shaft *c*, to which it is connected by the key *e*; this key is *sunk* or *let into* the shaft, and its projecting portion fits the key-way in the coupling. Fig. 76*a* is a sectional elevation, made by the plane S P, fig. 77*a*. The figures show the coupling for a $2\frac{1}{2}$″ shaft, drawn to a scale of $\frac{1}{8}$.

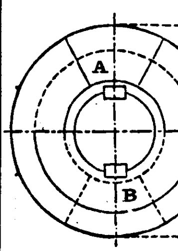


Fig. 75*a*.

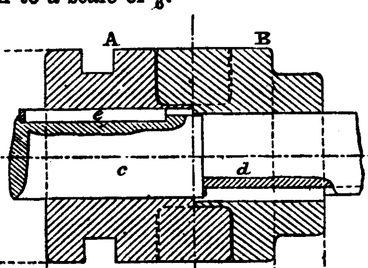
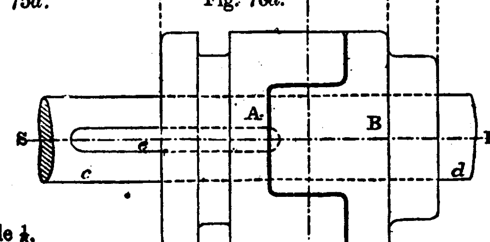


Fig. 76*a*.



Scale $\frac{1}{8}$.

Fig. 77*a*.

35. Helical or Screw Curve.—Figs. 78, 79, Plate VI., represent in front and end-elevation the helical curve, which is traced as follows:—If during the revolution of a cylinder a marker, which moves parallel to the axis of the cylinder and at a uniform rate, traces upon its surface a curve, the curve so traced is called the *helical or screw curve.* The distance moved through by the marker during one revolution of the cylinder is termed the *pitch,* and the direction in which it moves determines whether the curve is *right* or *left-hand.* Assuming the cylinder to be turning in the direction of the hands of a watch, as indicated in fig. 78, and the marker to move from right to left (0—16, 0—8 in fig. 79), the curve is *right-handed,* and *left-handed* if *vice versâ.* The curves shown in figs. 78, 79, are right-handed and of the same pitch, but differing in diameter; the pitch is the distance *ab* (0—16). In the example illustrated, the curves are supposed to be fine wires bent to the required form, or the cylinders upon which they are traced are supposed to be transparent, so that the back half of the curve may be seen; the front half of the curve is marked 0—8, the back half 8—16. If the curve were a left-handed one, the portion marked 8—16 would be the front, and that marked 0—8 the back half.

The length of the curve is equal to the hypothenuse of a right-angled triangle *abc*, fig. 81, having for its base the circumference of the cylinder, fig. 80, and for its height the pitch *ab*, fig. 82. And if the triangle be

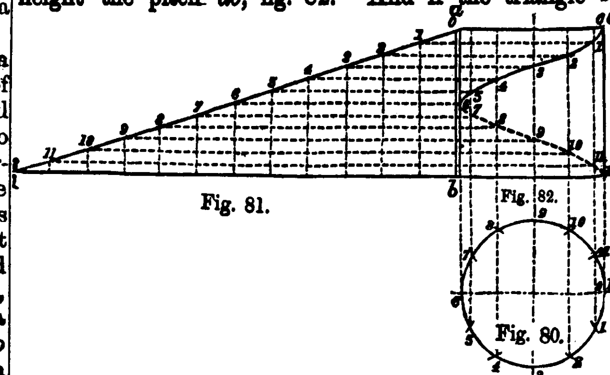


Fig. 81. Fig. 82. Fig. 80.

wound round the cylinder, keeping the base at right angles to the axis, the hypothenuse will assume the curved form shown in figs. 82 and 79, where ab = the pitch, bc = the circumference of the cylinder, and ac = the length of the curve. *ac*, fig. 81, is a *development* of the curve.

36. The drawing of the curve is as follows:—Having the diameter of the cylinder and the pitch of the curve given; for the larger curve, divide the circumference of the circle, fig. 78, into any convenient number of equal parts, divisible by 4, as 12 or 16; and the pitch *ab*, in fig. 79, into the same number of equal parts; in the example we use 16, numbering the points 1, 2, &c., to 16, respectively in both figures. From 16, 1, 2, &c., to 8 (9 to 15 being in the same lines as the former), in fig. 78, draw lines parallel to the axis of the cylinder *cc*, and from 1, 2, &c., to 16, in fig. 79, lines perpendicular to the axis; the intersections of the lines 1—1, 2—2, 3—3, &c., are points in the curve; join these points and the curve is complete. In the top half of fig. 79, between *b*, *d*, is shown a quarter of this larger curve, numbered 4 to 8. In the lower half, between *b*, *d*, is shown a quarter of the smaller curve, numbered 0 to 4, which can be obtained similarly, the construction lines indicating clearly how to project it. In the examples, figs. 78 to 82, we have taken a sufficient number of points to determine the curve with a sufficient degree of accuracy for ordinary purposes; if greater accuracy is required it can be obtained by taking a larger number of points on the circumference of the circle, and the same number between *a* and *b*. It will be noticed the curve is *quickest* between 0—2 and 6—8, figs. 78, 79; intermediate points may be taken between these to determine the curve more accurately.

37. Screws.—Screws are made by cutting helical grooves, of a triangular, square, or other cross-section,* in cylindrical pieces of metal or wood; the ridge or projecting part is termed the *thread;* the *pitch* is the distance between two consecutive threads, measured as described for the helix, Art. 35, page 33. The two common kinds of screws in use, excepting those for wood, are the V or triangular and the square-threaded; the former is chiefly used for *bolts, studs,* and *set-screws;* the latter to transmit motion by means of slides, as in the slides of lathes, planing machines, and other engineering tools, &c.

* A section made by a plane perpendicular to the direction of the length of the groove.

PLATE II.

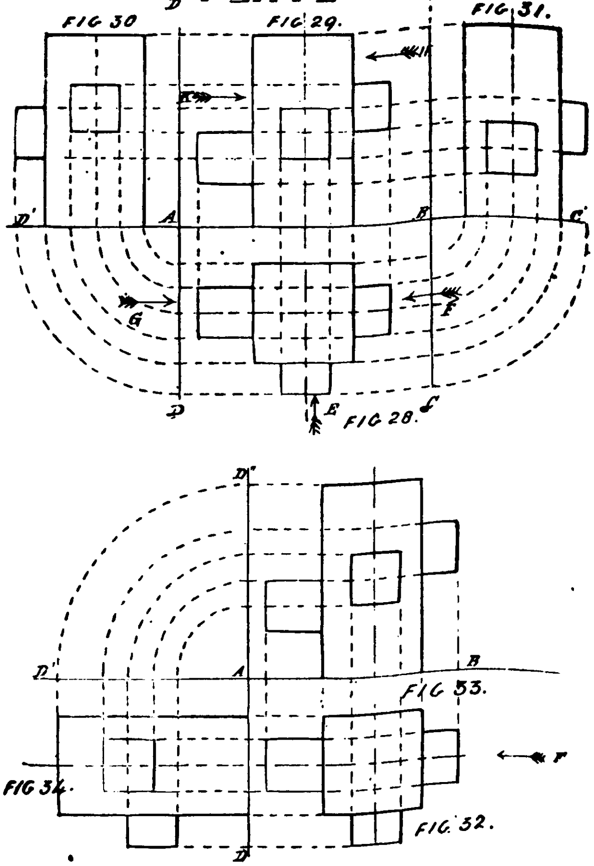


PLATE III

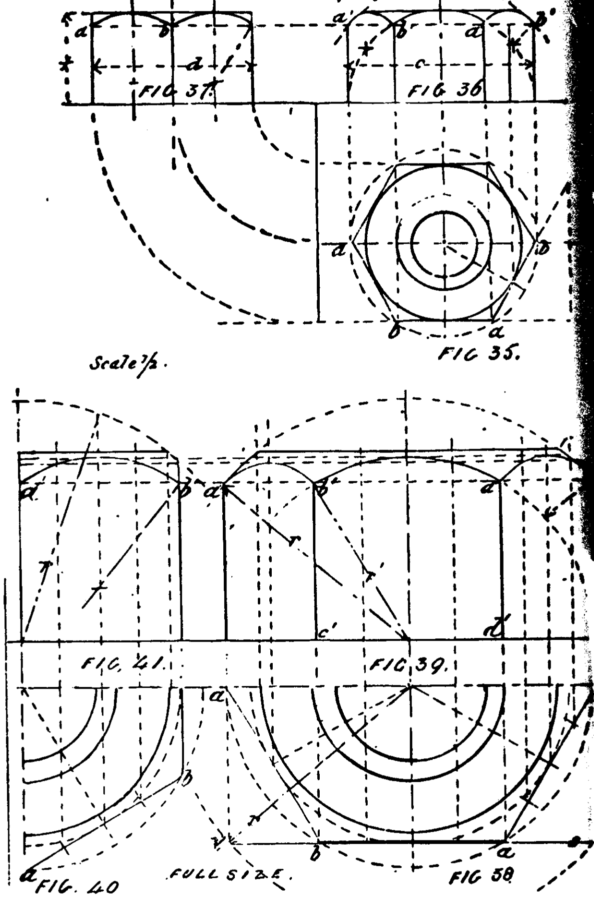


PLATE IV.

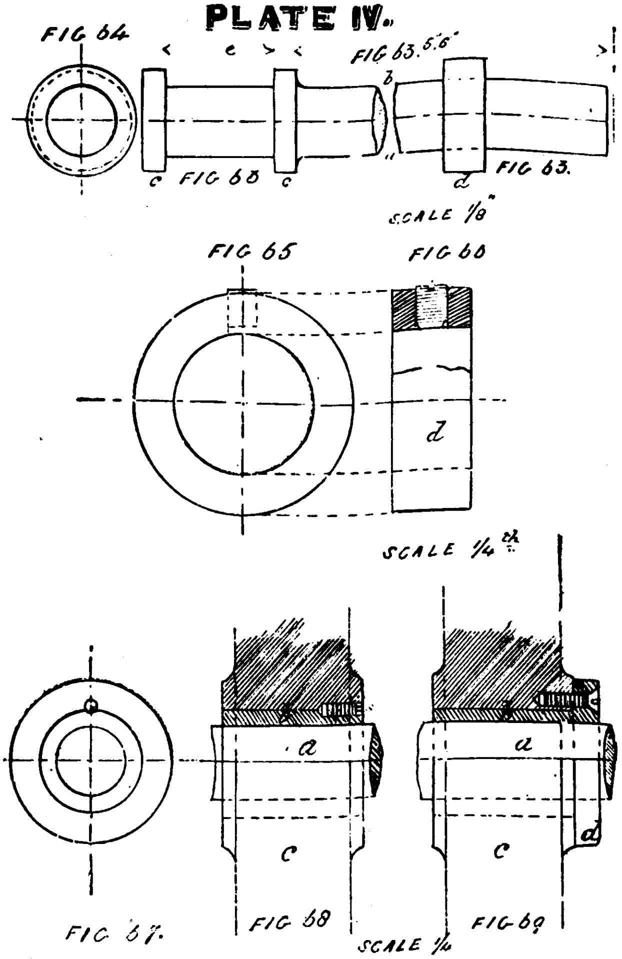
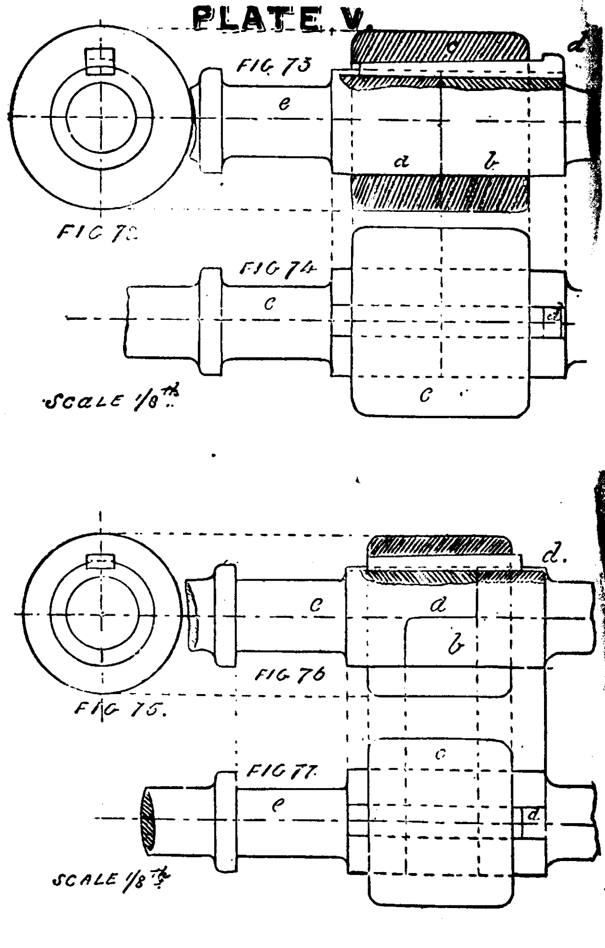


PLATE V.



38. The V-threaded screw is represented on Plate VI., figs. 83 and 84. It is usual to denote the pitch, which varies according to the diameter of the screw, by so many threads per inch in length; in the example shown the screw is $2\frac{1}{4}''$ diameter, and has 4 threads per inch, equivalent to $\frac{1}{4}''$ pitch. In fig. 84 *ab* is the pitch, which is set off along the centre line, or upon the outline of the cylinder, as shown at 4, 4, *a*, *b*; having thus divided the screw for the pitch, draw *aa'*, *ab'*, so that *a'ab'* contains an angle of 55°, *aa'*, *ab'* being equally inclined to the axis; from *b* draw *bb'* parallel to *aa'* meeting *ab'* in *b'*; *b'* is the bottom of the groove; draw *b'*4' parallel to the axis, meeting the centre line of fig. 83 in 4'; with C4' as a radius, describe the semicircle 4'2'0', which will represent the bottom of the groove or thread.

The curves 4*b*, 4*a*, *aa*, *bb*, &c., which form the tops of the threads, and *a'a'*, *b'b'*, &c., which form the bottoms of the threads, are obtained in the same manner as described for the previous figures. The groove *ab'b*, fig. 84, is termed the *space*, and is occupied by a projecting thread in the nut. In this example we have divided the semicircles which form half the end-elevation into 4 equal parts, and, therefore, the pitch into 8 equal parts. As each curve in making a revolution passes through a space *ab*, half the curve, as seen in fig. 84, will have passed through the space *cb*, or $\frac{1}{2}ab$, numbered 1, 2, 3, 4. Fig. 85 shows an enlarged section of the thread. In drawing the V we may either draw *aa'* inclined to the axis at $62\frac{1}{2}°$ $(90°—\frac{55°}{2})$ by setting off the angle by means of a *protractor* from a horizontal line, as the axis, or by placing the protractor at *a*, perpendicular to the axis, and marking off a line *aa'* inclined to *ae* at $27\frac{1}{2}°$ ($\frac{1}{2}$ of 55°), *ab'* being drawn in a similar manner. Having determined the curves for the top and bottom of the thread, as shown by the dotted lines on the left-hand of fig. 84, the remaining curves may be drawn by means of *templates*, consisting of thin wood or card-board cut to the required form. The templates for the curves *a'a'*, *aa*, &c., fig. 84, are shown in figs. 84*a*, 84*b*. It is much better to make separate templates for the different curves, than to try and make use of the ordinary *moulds* or *curves*. The thread we have described is the "*Whitworth Screw Thread*."*

Fig. 84*a*.

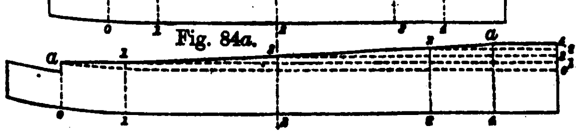


Fig. 84*b*.

In fig. 84 we have shown the thread of the screw with angular top and bottom; this, however, is not quite correct, but for convenience in drawing we may assume it to be so. The Whitworth screw thread has $\frac{1}{6}$ of the depth rounded off at the top and bottom, as shown in fig. 85.

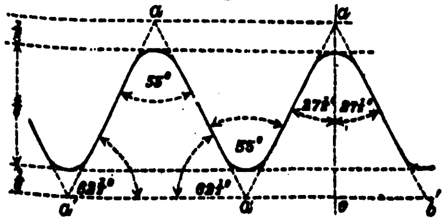


Fig. 85.

* Introduced by Mr. Joseph Whitworth of Manchester, now Sir Joseph Whitworth, Bart.

39. The following table contains a list of the number of threads per inch in length for screws from $\frac{1}{16}''$ to 6" diameter, according to the *Whitworth Standard*:—

TABLE II.

Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.
$\frac{1}{16}$	60	$\frac{5}{8}$	11	$1\frac{3}{4}$	5	$3\frac{1}{2}$	$3\frac{1}{4}$
$\frac{3}{32}$	48	$\frac{11}{16}$	11	$1\frac{7}{8}$	$4\frac{1}{2}$	$3\frac{3}{4}$	3
$\frac{1}{8}$	40	$\frac{3}{4}$	10	2	$4\frac{1}{2}$	4	3
$\frac{5}{32}$	32	$\frac{13}{16}$	10	$2\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{1}{4}$	$2\frac{7}{8}$
$\frac{3}{16}$	24	$\frac{7}{8}$	9	$2\frac{1}{4}$	4	$4\frac{1}{2}$	$2\frac{7}{8}$
$\frac{7}{32}$	24	$\frac{15}{16}$	9	$2\frac{3}{8}$	4	$4\frac{3}{4}$	$2\frac{3}{4}$
$\frac{1}{4}$	20	1	8	$2\frac{1}{2}$	4	5	$2\frac{3}{4}$
$\frac{5}{16}$	18	$1\frac{1}{8}$	7	$2\frac{5}{8}$	4	$5\frac{1}{4}$	$2\frac{5}{8}$
$\frac{3}{8}$	16	$1\frac{1}{4}$	7	$2\frac{3}{4}$	$3\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{5}{8}$
$\frac{7}{16}$	14	$1\frac{3}{8}$	6	$2\frac{7}{8}$	$3\frac{1}{2}$	$5\frac{3}{4}$	$2\frac{1}{2}$
$\frac{1}{2}$	12	$1\frac{1}{2}$	6	3	$3\frac{1}{2}$	6	$2\frac{1}{2}$
$\frac{9}{16}$	12	$1\frac{5}{8}$	5	$3\frac{1}{4}$	$3\frac{1}{4}$		

40. **Square-Threaded Screws.**—Plate VII., figs. 86, 87 represent a right-handed square-threaded screw $2\frac{1}{2}''$ diameter, and having two threads per inch, or $\frac{1}{2}''$ pitch. A section of the thread of the screw made by a plane passing through SP, fig. 86, is a square whose side = $\frac{1}{2}$ the pitch, the space being a square of equal side. The thread and space, therefore, make up the pitch; but this refers only to *single-threaded screws*. We shall refer to this point shortly. The curves for the elevation of the screw, fig. 87, are projected in a manner similar to that of the preceding examples, as shown by the construction lines; the only difference is in the form of the thread, there being two parallel curves for the top and two for the bottom of the thread in square-threaded screws. At *ef*, fig. 87, the back half of the thread is shown in dotted lines, portions of which, *fg*, *eh*, are in full where they cross the space. It will be noticed the dotted curves are inclined in the opposite direction to those shown in full.

41. As previously stated, Art. 28, page 29, the bearings of screws are *nuts* which fit the former accurately. Figs. 88, 89, represent in half-plan and sectional elevation a nut for the screw shown in figs. 86, 87. The curves are exactly similar to those of the screw, and in the half shown in fig. 89, they are inclined in the same direction as the dotted curves *ef*, fig. 87; in the half of the nut removed they are in the opposite direction.

The construction lines show how fig. 89 is drawn. Fig. 90 is a section of the threads of the screw and nut, showing them in contact.

42. In figs. 83, 84, and 86, 87, we have shown how to draw the true form of the threads of screws, V and square-threaded; however, in most instances, approximations to the true form are employed, and, generally, the smaller the scale of the drawing the further the approximations are carried. Figs. 91, 92, Plate VIII., represent the V-threaded screw shown in figs. 83, 84, drawn to a scale of $\frac{1}{2}$; the curved lines *aa*, *a'a'* are here replaced by straight lines. Fig. 94 is drawn to a scale of $\frac{1}{4}$, the Vs not being shown. In smaller scale drawings lines are used to represent the tops of the threads only, as at *e*, *d*, fig. 70. Figs. 95, 96 represent a *right-handed double square-threaded screw*, $2\frac{1}{2}''$ diameter, 1" pitch, scale $\frac{1}{2}$. The curved lines are replaced by straight ones. As there are two independent threads on this screw, the sections of the thread and space will be squares whose sides = $\frac{1}{4}$ the pitch. If there were three threads on the screw, then the squares would have sides of $\frac{1}{6}$ the pitch.

(*To be continued.*)

Health and Home.

CARBOLATE OF SODA FOR WHOOPING COUGH.

Dr. Pernot describes in the Lyons *Medical Record* a very successful treatment of whooping cough with carbolate of soda. He places the carbolate of soda in a small porcelain crucible held above the flame of a spirit lamp, which keeps it in an unvarying temperature as long as wished. As the carbolate of soda becomes volatilized, the atmosphere of the sick room is impregnated with the vapor of carbolic acid.

When the crucible and lamp are not at hand, a satisfactory substitute is found in a fire-brick heated enough to vaporize the carbolate. In numerous cases the following results have been obtained:—

1. A notable diminution of the paroxysms of coughing after from two to ten days' treatment. 2. Less laboured and painful respiration. 3. Shorter duration of the paroxysms of coughing. 4. The most confirmed attack of whooping cough remains *in statu quo* from the commencement, and it always appeared to him to diminish more or less rapidly, but always in a time relatively short to its usual duration.

The vapors of carbolate of soda have valuable disinfecting and antiseptic properties.

It is worthy of note in this connection that the fungoid origin of whooping cough, asserted some years since by M. Svetzerich, seems to be confirmed by the recent researches of M. Yschamar, who says he has found certain lower organisms in the spittle of whooping cough patients—organisms not met with in any other disease accompanied by cough and expectoration. He claims, further, that the organisms in question are identical with those which, by their agglomeration, form the black points on the skins of oranges and the parings of certain fruits, especially apples. Thus, M. Yschamar, by innoculating rabbits with this dark matter, or even causing it to be inhaled by men, produced fits of coughing several days in duration, and presenting all the characteristics of the convulsive whooping cough.

POISONOUS COLORS.

According to the *Chemical Review*, energetic steps are being taken in Switzerland against the use of poisonous colors. The Governing Council of Zurich has prohibited the use of all coloring matters prepared from the compounds of the metals lead, arsenic, copper, chrome, zinc, antimony, bismuth, and mercury, for decorating articles of consumption or of clothing, or their materials; also paper for wrapping up chocolate, coffee, tea, chiccory, tobacco, and eatables in general; toys, covers and cushions of children's carriages, carpets, curtains and window blinds, lamp screens, wafers, and table services. Poisonous organic matters, such as gamboge, picric acid, the aniline colors, especially magenta, are not to be used for coloring articles of food or drink, such as confectionery, jams, sirups, wines, &c. The same rule applies to the phenol colors. Imported articles containing such poisons may not be sold.

WHAT TO DO IN CASE OF DIPHTHERIA.

(From the Circular of the Massachusetts State Board of Health.)

In the first place, as diphtheria is a contagious disease, and under certain circumstances not entirely known, very highly so, it is important that all practical means should be taken to separate the sick from the well. As it is also infectious, woolen clothes, carpets, curtains, hangings, &c., should be avoided in the sick room, and only such materials used as can be readily washed.

All clothes, when removed from the patient, should be at once placed in hot water. Pocket-handkerchiefs should be laid aside, and in their stead soft pieces of linen or cotton cloth should be used, and at once burned.

Disinfectants should always be placed in the vessel containing the expectoration, and may be used somewhat freely in the sick room; those being especially useful which destroy bad odors without causing others (nitrate of lead, chloride of zinc, &c.) In schools there should be especial supervision, as the disease is often so mild in its early stages as not to attract common attention; and no child should be allowed to attend school from an infected house, until allowed to do so by a competent physician. In the case of young children, all reasonable care should be taken to prevent undue exposure to the cold.

Pure water for drinking should be used, avoiding contaminated sources for supply; ventilation should be insisted on, and local drainage must be carefully attended to. Privies and cesspools, where they exist, should be frequently emptied and disinfected; slop water should not be allowed to soak into the surface of the ground near dwelling houses, and the cellars should be kept dry and sweet. In cities, especially in tidal districts, basins, baths, &c., as now connected with drains, should never communicate directly with sleeping rooms.

In all cases of diphtheria, fully as great care should be taken in disinfecting the sick room, after use, as in scarlet fever. After a death from diphtheria, the clothing disused should be burned or exposed to nearly or quite a heat of boiling water; the body should be placed as early as practicable in the coffin, with disinfectants, and the coffin should be tightly closed. Children, at least, and better adults also in most cases, should not attend a funeral from a house in which a death from diphtheria has occurred. But with suitable precautions, it is not necessary that the funeral should be private, provided the corpse be not in any way exposed.

Although it is not at present possible to remove at once all sources of epidemic disease, yet the frequent visitation of such disease, and especially its continued prevalence, may be taken as sufficient evidence of insanitary surroundings, and of sources of sickness to a certain extent preventable.

It should be distinctly understood that no amount of artificial "disinfection" can ever take the place of pure air, good water, and proper drainage, which cannot be gained without prompt and efficient removal of all filth, whether from slaughter houses, &c., public buildings, crowded tenements, or private residences.

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.

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: Glycerine 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.

LIME JUICE FOR RHEUMATISM.—In the *Canada Lancet*, Dr. A. H. Chandler calls attention anew to the use of an old remedy, and reports several severe cases in which good results followed its use. Without regard to the condition of the bowels,—unless previously much constipated—he begins with at least ten ounces of lime juice, increasing rapidly to eighteen or twenty-four per diem—from half an ounce to one ounce or more every hour, with not less than double or treble the quantity of cold water, usually diluted and sweetened to the patient's taste. He finds that even on the second day the amendment is decided, and the disease, in acute cases, more particular sthenic or asthenic, generally subsides on the fourth or fifth day of treatment. He usually prescribes one grain of opium, with or without lead and tannin, night and morning, in order to restrain the bowels which the juice has a tendency to relax. The effects of this treatment are, he says, rapid diminution of joint swelling, diminished perspiration, steady fall of pulse, which often becomes quite slow, with a slight tendency to syncope, the majority of cases requiring quinine and supporting food about the sixth day. Such vigorous treatment should evidently be undertaken only under the supervision of a competent physician.

SOMETHING WORTH KNOWING FOR PIECING BELTS.—I have received great practical benefit from reading your excellent paper, and can only wish it had more of practical mechanics and less of star-gazing in it. Our musical friends appear to have had a good benefit. Let us hope that it will be the cotton spinners and general mechanic's turn some day. The science of cotton-spinning has yet to be written, and it would be a capital thing if some of your many readers in that large industry would state the difficulties they have met with in the working of material, in machinery, and what may appear trifling manipulations, and how they overcame them.

As a very little thing, I send my quota about piecing belts. Belts breaking are a daily nuisance, and I have tried all sorts of things from Helvetia laces to patent fasteners, but find nothing so good or so cheap as nails. If you want a belt to last whilst there is a bit of good leather in it, for spinning looms or bleaching, nail it. The best kind of nail is one with a countersink head, about ¾ in. long. Nail it diagonally. Of course narrow belts want lighter nails. B.