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SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE
AND
PATENT OFFICE RECORD

Vol. 8. OCTOBER, 1880. No. 10.

THE CANADIAN EXHIBITION OF 1880.

THE press of Montreal,—the city in which the Canadian Exhibition for this year was held—has given such full details of the various manufactures and industries of the country; machinery, agricultural implements, produce, &c., which were exhibited, that it would be a mere work of supererogation to repeat what probably has been read throughout the Dominion. We will confine ourselves, therefore, to a few remarks in the form of well intended criticism, both on the Exhibition itself, and the management. The public journals, we observe, have been very reticent about making known the complaints of the public of a want of foresight and proper management by the Committee, nor were those complaints by any means frivolous; certainly, it was very desirable not to throw any reflection upon the affair that would deter the public from visiting our city, but we do think, now it is over, it would be wise to point out the mistakes that were made in order to avoid any recurrence of the same in future.

The apology which is so frequently upon the tongues of Canadians, as an excuse for deficiency—that we are but a young country yet, and, that everything not up to the line of excellence is excusable, and anything of mediocre merit is deserving of praise, because it is the effort of a young country, is not only unmanly, but unworthy of our nationality. It is true that we are a young country, compared with the age of European nations, but it must be borne in mind that, if our country is young in years, we are an old people, descended from two races that have ever been foremost in energy and excellence. We are, therefore, members of those races, inheriting all the intellectual ability of our forefathers, but instead of living in the land of our ancestors, we have simply transplanted ourselves to another soil. Steam and the Telegraph has brought us nearer to them to-day, in a business point of view, than people residing in London, fifty years ago, were to those who lived in Liverpool. All that science has done for the old world we participate in; the labours of centuries is before us to benefit by. Whatever genius, talent, or skill, has produced, both on the Old Continent and the United States, is for our benefit. We have not to seek for light in darkness, nor have we to work with crude materials and imperfect implements. We have the same access to the great results of all that has been done for us, just as if we were living in the highest of civilized countries. We can buy the same machinery which produces such excellence in manufactures, as they can; we can obtain the skilled workmen of Great Britain and France, if we feel disposed to employ them; in fact, there is nothing in all the improvements of the past in art, science, or manufactures which it is not in our power to obtain; why then should we childishly take refuge for our defectiveness by harping on the cry, as an excuse, that we are but a young country? We would much sooner pass a few just and friendly criticisms, when necessary, then lead into error by praise undeserved.

That the Exhibition was a success—so far as numbers go—will be acknowledged by all. That it was remunerative, is beyond a doubt. But that it was a success, as a Dominion Exhibition, or in its management, we most decidedly deny. The Art Gallery contained little of real artistic worth, and of the exhibits altogether, there ought, and could have been a much greater show had a proper understanding been arrived at by all the provinces months before. Blame has been cast on Toronto; she has been accused of antagonism and selfishness, in not having decided upon a day for her Provincial Exhibition, until after the Dominion one had been proclaimed, and then, by fixing the opening day of hers a few days previous to ours, they drew off the bulk of the agricultural implements and produce in which she so much excels. Whether this action on the part of Toronto was done in an unfriendly spirit towards Montreal, or not, is more a matter of feeling than of fact. We feel disposed to believe it arose from a want of disposition, with both parties, to give way to the others' wishes. However, we trust that when the next Dominion Exhibition takes place there will be no provincial ones held at the same time to take anything away from it of interest to all, and also that its management will be put entirely into the hands of one competent person, and judges selected properly qualified for their duties.

In the main building the principal things worthy of notice were those articles manufactured in Canada, and for the excellence of which, when competing with other countries, it was desirable that we should obtain the highest mark. Certainly the exhibit of textile fabrics was undoubtedly excellent; also the manufacture of rubbers—in which the Canadian Rubber Co, and the North American Rubber Co., of Quebec, exhibited goods equal in style and finish, to any made in the United States. The Canadian Rubber Co. also had a very fine display of belts and other goods in their line. Messrs. Watson, & McArthur, had a very fine exhibit of wall paper; we were by no means prepared to see so fine a show, as it was not expected that this firm, which only commenced to print a few weeks ago, could have produced, at the very outset, such excellent paper and workmanship; taking the first prizes in excellence of manufacture and decorative paper. Among the manufactures of hardware, foremost, conspicuous, and most attractive as being connected with one of the greatest industries of the country, and the source of her greatest wealth,—was the exhibit of saws manufactured by James Robertson, of Montreal. This exhibit consisted of saws used principally for sawing lumber, from a circular saw of 6 feet diameter to the smallest used. The tasteful arrangement of these bright radiant blades, studded over a ground of black cloth, and under an awning of the Union Jack, was much admired, and was decidedly the most attractive feature in the Exhibition. As usual, Mr. Robertson not only took first and extra prizes, but a diploma as well.

We regretted to see so meagre a display in the machinery hall. There was nothing very remarkable to be seen there. The great centre of attraction appeared to be a machine for manufacturing horse-shoe nails.

There were, however, three things exhibited in this hall which had modestly taken their position in a corner, that deserved particular notice, and to which we desire to call the attention of all sanitarians, architects, builders and plumbers; and these were an improved water-closet, tank, and water-tap. These three articles are the invention of Mr. John Robertson, manager of the Montreal Rolling Mills. As we have always advocated so strongly in the columns of this Magazine sanitary reform, we hailed with much satisfaction this great improvement in water-closets, and would strongly recommend their adoption. Two particular features in this closet were much approved of; one was, that the trap was thoroughly emptied of its contents at each flushing, and simultaneously sealed with water into which no impure matter could enter. The other was, that it is worked without the aid of wires, a matter of much importance as wires are constantly breaking and getting out of order.

The arrangement on the grounds for the accommodation of the horses and cattle was deserving of all praise. The exhibit of these animals was very creditable; also the exhibit of poultry was very good, and the plan adopted for the public to see the birds, causing the people to go one way, is the plan that should have been adopted for the main building.

It is to be hoped that, at the next Exhibition, and all future Exhibitions, steps will be taken to prevent overcrowding of the buildings, and to put down the rudeness of the roughs. Had an example been summarily made of those Goths, who thought nothing of crushing feeble women and children, it would have had a very salutary effect.

THE ADHESION OF BELTS.

J. H. Cooper, a well-known writer, has the following in the Boston *Journal of Commerce*:

"The driving power of belts—by which we mean the holding on to, the adhesion, or that which imparts motion to a belt while in contact with a revolving pulley—has been attributed to several causes, to one of which I wish to refer—that of atmospheric pressure. It is called to mind now by reading some articles in late issues of your paper, which lay great stress upon the efficacy of this means of creating adhesion. This announcement is much like that startling physiological statement of the many tons of pressure imposed upon the human body by the atmosphere, which is very taking to the sense until better known.

"A belt has a movement to and from a pulley with perfect freedom, regardless of the atmosphere, *touching* it as its form, pliability and strain permit, and *holding* to it according to the interposed unguent, adhesive, or what not, which has been spread over the surface of the belt and pulley. The kind of adhesive used has much to do with the driving power of belts. Suppose fine lubricating oil be employed on clean surfaces of belt and pulley; this will effectually exclude the air from the surface of contact, but the driving power will be reduced to a minimum, if there be any at all transmitted. If dry dust of yielding material be employed on clean surfaces of belt and pulley, then indeed will the air, with the dust, diminish driving power. There are conditions of belt driving where it is alleged the interposed film of air *lessens* adhesion. Upon this, Rankin says: 'It is well known, through practical experience, that a belt for communicating motion between two pulleys, requires a greater tension to prevent it from slipping when it runs at a high than at a low speed. Various suppositions have been made to account for this, such as that of the adhesion to the belt of a layer of air, which, at a very high speed, has not time to escape from between the belt and the pulley. But the real cause is simply the centrifugal force of the belt, which acts against its tension, and therefore slackens its grip on the pulleys.'

"In collecting 'belting facts and figures,' during the last score of years, for my own use, I met with several statements asserting with considerable confidence the doctrine of 'suction' as the chief cause of attachment between pulley and belt; but I could not find anywhere written a fair statement of reasons why such force did not act according to the circumstances of belt driving, nor could I discover any appeal to experiment, which, by removing the atmosphere, in this case putting suction outside the apparatus, and thus settling once for all the value of vacuum for belt driving.

"It is very true, that if the belt does not touch the pulley, it cannot pull it around, nor can it be driven by the pulley. It is also true, that if the belt and pulley touch on a limited area only, each can drive the other with a force but a part of what it is capable of doing, and it is only when contact is made perfect—that is, when every square inch of the belt, so to speak, is down solid on the pulley surface, which surface we will grant is very smooth—that the greatest driving effect is obtained. These things being so, are we yet warranted in concluding that the imparting of motion from belt to pulley, and pulley to belt, is all the work of the air, or rather the effect of its absence from the region of contact, and the presence of it on opposite sides of belt and pulley?

"Again, is the driving of the belt in the same direction as that in which the suction is felt? Now, mark, the atmospheric resistance becomes sensible by pulling at 'right angles to a plane surface of joint which does not admit air.' Release the pull, and try to slip the *sucker* over the surface to which it is applied; it moves freely in every direction, offering no resistance, possessing no adhesion, being in fact in equilibrium, and, by lifting one edge, can be raised wholly away with ease. The power of the belt does not move in lines at right angles to its contact with the pulley face, but tangent to the pulley circle—parallel to the face of contact. As we slip the *sucker* freely on the flat wetted surface, so the belt slides on the pulley face; there is no atmospheric pressure manifest in either case.

"But has any one tested this matter in a vacuum, and made record of the results gained? I have; and, if, you allow me, will quote, from 'Use of Belting,' what I said about this several years ago: 'The adhesion of belts to pulleys is frequently attributed to the pressure of the atmosphere; and, in order to show how much the air influences belts in this particular, the following simple experiments are presented: Take circular discs of leather, say three or four inches in diameter, with a knotted string secured in its centre, and, when well water-soaked, press it upon any level wetted surface. The boys call this apparatus a "sucker," and it well illustrates the phenomenon of atmospheric pressure, or "suction," as it is usually called. If an effort be made to draw it away from this surface by the string, it will be found resisting very forcibly, but the gentlest pressure will slide it on the wetted surface. It does not offer the slightest opposition to motion in the direction of its face, nor will it resist removal if raised first at the edge and then peeled off. The atmosphere does not press two bodies together when it can get between them. It is only when excluded by a tight joint that the development of its pressure is possible; and it becomes sensible only when an effort is made to separate them by a force acting at right angles to the plane of their faces. Another simple experiment shows that when two level, smooth and clean surfaces come together, by a motion like the closing of a book—which is similar to that of a belt coming in contact with its pulley—there will be retained, between the two, a thin film of air; and while this remains, the contact of the two is imperfect, and the sliding of one over the other is easily performed. Take two iron "surface-plates" which have been scraped down to a practically perfect plane and lay one of these on the other like a belt goes on to a pulley. They will be found not in contact at all, but as if floating one on the other, and the top one will slide off by its own weight at the least inclination of the lower one. Much of this interposed film of air can be displaced by a sliding of one plate on the other, starting, say at one corner, with the plates in close contact, and carefully pushing one over the other, holding it the while close to, as if to keep the air out. Then, indeed, an obstinate resistance to sliding will be felt, and the friction of nearer contact will be made thoroughly sensible. But this way of bringing surfaces into contact has nothing to do with belt action, except to prove the need of plastic surface on belt and pulley, which will enable them to adhere, while in contact, with sufficient force to prevent sliding, and at the same time be uninfluenced by the intermedium of air. And, lastly, in order to put the matter to actual test, an apparatus was constructed, such that a leather belt was made to slide on the face of a smooth iron pulley, and also to drive the same iron pulley up to slipping off the belt. In both cases, the adhesion or driving power of the belt was held by a spring balance, so the work of the belt could be observed. Experiments were tried with this mechanism placed in a bell glass jar on the air-pump plate, with and without air in the jar, and if any difference was observed in the adhesion of the belt to the pulley, it had more in vacuum than when the atmosphere was present.'"

THE PERIL OF A MINER.

One of those thrilling episodes that occasionally enter into the life of a miner and illustrate its perils, occurred recently in the Wallace and Ferguson mine at Sheep Ranch, The shaft has two compartments, and is 400 ft. deep. Both compartments are used for hoisting purposes, signal bells being utilized to enable the engineer to distinguish between the divisions of the shaft. One day last week three men went down in the bucket, their destination being the 200 level. One of the trio, Thomas Taggert, got into the bucket, while the other two stood on its top and held on by the cable—the "usual way." Arriving at the 200-ft. station the men stepped off into the level, and Taggart had got partly out of the bucket when the bell in the other compartment gave the signal to hoist. The engineer mistook the signal and hoisted in the compartment in which the men had just gone down. Taggert was in the act of getting out of the bucket—had one leg out and one in, in fact—when the latter started up the shaft. The bucket, with Taggert hanging to it, had proceeded but a few feet when it tipped over, precipitating the unfortunate man headlong down the shaft. At the moment of falling—in utter desperation, as a drowning man grasps at a straw—Taggert caught at the rocky wall of the shaft with his hands. By a miracle of good fortune, one of his wrists lodged in a wedge-shaped interstice in the side of the shaft, and Taggart hung by one arm, suspended in mid-air with 200 ft. of space beneath him. No one can have the faintest conception of the unutterable horror of such a position. Enveloped in impenetrable darkness, suspended by one arm over an abyss that invited him to certain death if his frail support should give away, and alive to the knowledge that the descending bucket might precipitate such a catastrophe, Taggert's situation was so inexpressibly horrible that its contemplation makes one shudder. Luckily, however, his comrades comprehended the situation of affairs, and by acting promptly prevented a tragic ending of the accident. Taggert was released from his perilous position, escaping any more serious injury than a severe strain of his physical system and mental faculties.—*Calaveras Chronicle.*

SALVES AND PLASTERS.

The tinsmith or plumber who goes through a year's work at his trade without a severe cut or burn is fortunate, but he considers himself equally fortunate if, in the case of a severe injury, he escapes from the dangers of salves and plasters. In regard to their injurious effects upon the skin, Dr. Van der Weyde, whose skill in medecine is quite equal to his knowledge of science, says:

"Plasters and salves are more dangerous even than oil silk or rubber overshoes, as they are usually applied to wounds and sores, and in many cases produce more harm, than they do good, as they usually protract the cure, and often prevent it entirely. The cause is simply that plasters and salves are mostly water-proof, and therefore interfere with the natural function of the skin; if either of them is placed on a sound portion of the skin; and kept there for a few days the skin becomes sore. Their application is often the cause of the difficulty in healing wounds. Scores of cases have come under our notice where our advice to dispense with the use of so-called healing salves caused a finger which had been sore for months and kept sore by the continual application of different kinds of salves, to heal rapidly as soon as the use of salves was discontinued.

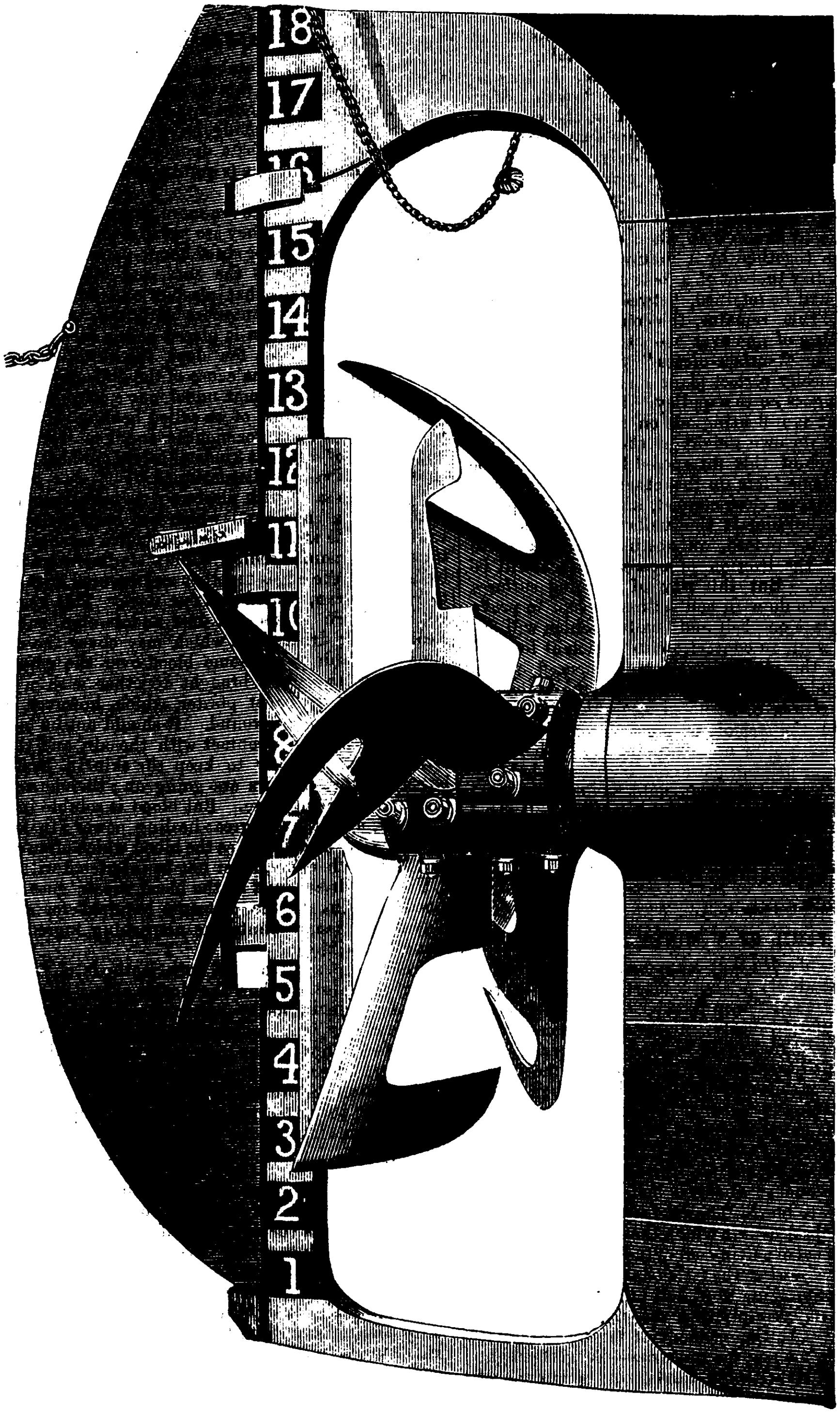
"It is the same with plasters; we have seen it over and over again, that a cut wound which had been covered with a plaster to shut off the air, as a foolish prejudice teaches, had a most protracted and painful course, while a similar wound, simply treated by bringing the edges together and covered with a piece of linen to keep it clean, healed in a few days. This keeping clean does not only mean to keep off dust and foreign substances, but to clean off the dried blood which may cover the cut. It is even often advisable to put some blood over the edges of the wound after they have been brought together with a few stitches or narrow cross strips of plaster, which, however, must never be allowed to cover the wound. It should not be lost sight of that the skin is made for contact with the air, and that this contact is necessary, not only to keep the skin in healthy condition, but also when repairs are going on; therefore no water-proof plaster should interfere. But blood is soluble in water and absorbs air, and it has a great healing power; in fact, there is no healing salve so efficient as the blood which often covers a wound, and which, therefore, must not be interfered with, by any means.

Under a dried crust of the blood repair goes on actively, as blood contains all the elements required for such repair, and renewal of tissues wants the nourishing ingredients which are found in the blood.

From long experience of both methods of treatment, we can heartily indorse all that the doctor says. We have frequently treated severe burns by pasting a sheet of white tissue paper over them, using pure gum-Arabic freshly dissolved in water. The object of having the gum fresh was to make sure that it had not soured or fermented. Burns which have begun to fester from the use of oils or ointments will frequently yield at once to such treatment, the swelling and inflammation quickly subsiding, healing beginning and the pain ceasing.

Is It So?—A foreign scientific journal remarks, as a curious physiological fact, that although open-air life is so favorable to health, yet it has the apparent effect of stunting the growth in early youth. Thus, while the children of well-to-do parents, carefully housed and tended, are found to be taller for their age than the children of the poor, they are not so strong in after years; the laborer's children, for instance, who play in the lonely country roads and fields all day, whose parents lock their humble doors when leaving for work in the morning, so that their offspring shall not gain entrance and do mischief, are almost invariably short for their age; the children of working farmers exhibit the same peculiarity. After sixteen or eighteen —after years of hesitation, as it were—the lads shoot up, and become great hulking, broad fellows, possessed of immense strength. According to these statements, it would seem that in-door life forces growth at the wrong period, and thus injures. Is it so?

Alum and plaster of Paris, well mixed in water and used in the liquid state, form a hard composition and also a useful cement.



THE DE BAY PROPELLOR.—THE TWO HUBS WITH THEIR BLADES MOVE IN CONTRARY DIRECTIONS.

THE DE BAY PROPELLOR.

The De Bay propellor, an English invention, which has attracted much attention since its efficiency was made public by a series of experiments in 1879, has recently been fitted to a steamship of a sufficient size to give a decided test of its value. The *Cora Maria*, a steamer of 831 tons net register and 2,800 tons displacement, was the vessel used for the experiments. Her dimensions are: Length, 235 feet; breadth, 31 feet; depth, 18 feet 3 inches. Her engines are of the compound inverted cylinder and surface condensing type, the high pressure cylinder being 28 inches, and the low pressure cylinder being 54 inches in diameter, with a stroke of 3 feet. The screw used in the first experiment was an ordinary four-bladed screw, having a diameter of 13 feet 2½ inches, and a pitch of 19 feet 6 inches. With this screw a trial was made over a course of two and one-fifth knots on the 10th of July last, and then the DeBay gearing and propellor (diameter 11 feet) were fitted to the vessel and a trial was made under exactly similar conditions on the 10th of August. The results obtained from each trial are herewith tabulated for comparison, it being understood that in each case four runs over the course were made, the first and third being with the tide and the second and fourth against it.

	Ordinary screw.	De Bay propellor.
Average revolutions per minute	66·32	65
Average steam pressure, pounds	74·7	74·5
Average vacuum, inches	25·58	24·25
Indicated horse power	584·51	585·

TIME.

	First course.	Second.	Third.	Fourth.
Ordinary screw	12m. 5s.	20m. 27s.	12m. 3s.	19m. 56s.
De Bay propellor	9m. 4s.	16m. 42s.	9m. 6s.	16m. 10s.

SPEED IN KNOTS PER HOUR.

	First course.	Second.	Third.	Fourth.
Ordinary screw	10·924	6·45	10·954	6·62
De Bay propellor	14·567	7·898	14·505	8·162

TURNING THE CIRCLE.

	Ordinary screw.	De Bay propellor.
To port	4m. 44s.	4m. 33s.
To starboard	6m. 51s.	5m. 4s.

The mean speed obtained on each trial was 8·73 knots for the ordinary screw and 11·28 knots for the De Bay propellor, or an actual gain for the latter of over 29 per cent. for the same expenditure of power. Assuming that the resistance varies as the cube of the speed (and practically this ratio is greatly exceeded), since it required 584·51 horse power to drive the *Cora Maria* at a mean speed of 8·73 knots with the ordinary screw, it would have required 1,256·69 horse power to drive her at the speed of 11·28 knots obtained by the De Bay propellor. We might easily go on to calculate the immense saving in fuel thus obtained, but the foregoing figures are sufficient to call attention to the advantages of the new propellor.

With the ordinary screw there is, as every one knows, a great deal of vibration, and the stern of a screw steamer shakes and quivers very unpleasantly; while the De Bay invention produces no local commotion at all.

Since the first trial in 1879 the shape of the larger half of the propellor blades has been somewhat altered. Formerly they were designed so that they nearly filled up a segment of a circle having the same diameter as the propellor. They now have a curved form in place of an angle, and each blade, instead of a uniformly increasing pitch, has a pitch of 17 feet to half radius; increasing therefrom to a pitch of 19 feet to 21 feet.

The *Cora Maria* is now on a voyage to Alexandria, Egypt, with a full cargo, and the reports of her captain and engineer will be awaited with great interest.

—The trial of the *Albert Victor*, the new steamer for the Channel service for the South Eastern Railway Company, is a triumph for all concerned in her building. Not only is she a very fast vessel, but is remarkably steady and dry. The *Albert Victor* is 250 ft. in length, 29 ft. in breadth, and 15 ft. 6 in. depth; her builder's tonnage is 1,040 tons, and the horse-power developed by her oscillating paddle engines is 2,800. She made the run from Gravesend to Folkestone, a distance of 84 miles, in 3 hours 46 minutes, the weather being rather unfavorable. A cracked cylinder has, however, necessitated her return to the Thames.

THE FURNITURE AND CABINET FINISHER.

This is another of those useful manuals published by Jesse Haney & Co., and which should be in the hand of every cabinet-maker, it being a practical guide, giving the latest approved methods and recipes for this branch of woodwork.—Among the many valuable chapters for finishing we may mention, those on polishing materials, puttying, glueing, varnishing, darkening wood, preparing wood for finishing, bleaching, stains for all kinds of wood, dyeing wood, fillers, piano finish, dead finish, oil finish, wax finish, French polish, enamelling furniture, tables of tints, painting, ornamentation, graining, marbling on wood, veneering, marqueterie, Buhl work, inlaying, and many miscellaneous receipts.

Parties desiring this work can obtain the same by remitting 50 cents to F. N. Boxer, 243 St. Denis St, Montreal.

Boiler Inspection in France.—It is stated that the systematic inspection of boilers, especially in the north of France, has been attended with the happiest results. The French government has recognized as "of public utility" the Steam Users' Association of the Nord, which was founded in 1873. Its objects are the prevention of explosions and other accidents, and the dissemination of useful information as to the generation of steam, together with remarkable facts and discoveries relating to economy of fuel. The board of management consists of twelve members, elected at the annual general meeting and its staff comprises an engineer-in-chief, three other engineers, for inspectors, three draughtsmen, and an accountant and treasurer. The engineers are selected from among the old pupils of the Ecole Polytechnique and the Institut Industriel du Nord; the inspectors from the first-class engineers on railways, and the best pupils at the Ecole des Arts et Métiers et Chalons. Two inspections are annually made on the premises of members. The first is confined to the external parts of the boiler and its appurtenances, the engineer at the same time giving such useful hints to the engine tender as may seem necessary. The second is a more minute examination, inside and out, and a written report is afterward presented to the responsible manager. The number of boilers under inspection has increased from 526 to 1,108 belonging to 328 establishments, and with the following results:

	1873-4. Per ct.	1876-7. Per ct.
Steam gauge in good condition	40	92
Safety valves in good condition	63	88
Boilers with glass tubes	90	78
Number of boilers with old-fashioned water guages	65	4

Only two accidents have occurred since 1873. In one case the owner of the boiler had just joined the association, and his premises had not been thoroughly inspected, while in the other, the manufacturer had objected to that course, and thus rendered himself liable to expulsion from the society.—*Iron*.

—The *American Journal of Pharmacy* notices the occurence, in the Russian Caucasus, of two lakes which contain immense quantities of *sodium sulphate*, from which this salt is obtained in an almost pure state. The lakes have no exit, fill up in the wet season, and in summer their contents partially evaporate. The salt is obtained in layers of from a quarter to four inches thick, as it separates in consequence of cold or by evaporation in summer. Samples that were analyzed showed that the dry salt contains 95 per cent. pure sulphate, of which it has been estimated the two lakes should yield 200,000 tons. It is further said that a French company has been formed to work this deposit systematically. Of the origin of the salt our informant gives no explanation.

—Mr. R. F. Fairthorne suggests in the *American Journal of Pharmacy*, that if 3 ounces of powdered quicklime be added to a gallon of benzine, and the mixture be well shaken, most of the peculiar *sulphureted-odor of the benzine* will be removed, and articles that have been washed in it will have no disagreeable smell.

Orders have been given for a cane sugar refinery, to be erected at Tilsonburg, Ont.

John Robinson, of the Bothwell Agricultural Works, is going largely into the manufacture of iron fencing.

DANGER IN TOUGHENED GLASS.

Several accidents have recently been reported of the sudden explosion of drinking glasses made of toughened glass, one of which we give below as communicated to the editor of London *Nature:* A lady of my family emptied a powder composed of 7½ grains of carbonate of potash and 7½ grains of carbonate of soda into a tumbler of what is called toughened glass less than half full of cold water. After stirring the mixture she drank the contents leaving a silver teaspoon in the glass, and then placed the empty tumbler on the table by her side, within, perhaps a foot of a burning duplex lamp. About five minutes afterward a sharp explosion occurred, which startled all in the room. We found the tumbler shattered into fragments, the body of the glass ripped up, as it were, into several large, irregular-curved pieces, and the bottom of the tumbler broken into small pieces, more resembling thick, rough ice than anything else. Query: Was the explosion caused by the inherent propeities of the toughened glass, or by the contact of potash, soda, the silver spoon and proximity to a lamp, the heat from which was very slight; indeed, scarcely perceptible to the hand at the spot where the tumbler stood?

The accident might have been very serious, for pieces of the glass flew to within a very few inches of the lady's face. A solution of the cause of the explosion is therefore of considerable importance to all who may have occasion to use vessels of this peculiar glass.

We have not, as yet, seen any solution of the cause of such explosions, one of which occurred while the glass was yet in the hand of a person who had just quaffed its contents. We may remark, however, that toughened glass when broken does not present sharp edges, or points, as in the case with ordinary glass by which it is rendered more dangerous. Toughened glass breaks very much as does glass that is suddenly cooled, as Prince Rupert drops, which may be safely exploded in the hand and the broken fragments rubbed and handled almost as safely as so much coarse sand. The "explosions" probably arise from a sudden fracture of the outside skin of the glass, which from some reason in cooling, is drawn tight over the inner mass. In Prince Rupert drops that condition is caused by a sudden cooling of the outside by dropping the molten glass into water. Chilled cast-iron car wheels have been found in a condition under which a moderate blow from a hammer upon the face of the wheel has caused them to burst into numerous fragments.

THE THIRD INTERNATIONAL GEOGRAPHICAL CONGRESS.—Italy is preparing for a convention of scientific interest and importance—the Third International Geographical Congress, to be held at Venice next year. The Second Congress, which was held at Paris in 1875, intrusted to the Geographical Society of that city the care of providing for the next meeting. The result was a proposal to the Italian Geographical Society, whose headquarters are at Rome, to hold the Third Congress, accompanied by a Geographical Exposition under its auspices, at Venice, in September, 1881. In order to continue the memorable successes of the First Congress at Antwerp, in 1871, and the second at Paris, in 1855, the managers of the Third Congress bespeak an early and general attention to their own undertaking. There is abundant reason for supposing that success will crown their efforts; for great advances have been made in geographical science during the last five years, not alone in explorations of unknown and little known lands, but in mathematical geography, which includes exact topography; in hydrography, which includes the geography of the oceans and the rivers, and embraces the deep-sea soundings; in physical geography, which covers meteorology, geology, botany, zoölogy; in historic geography, which takes in ethnology and also the progress of the study of geography; and in economic geography, which embraces commercial facts and statistics. All of these geographical groups the Congress expressly provides for.—*New York Sun, Sept. 28.*

THE WASTE OF VALUABLE PRODUCTS IN COKE-MAKING is strongly commented upon by Dr. Angus Smith, Inspector under the Alkali Acts in England. He calls attention to the fact that, in the combustion of every ton of coal made into coke, twenty pounds of ammonia are given off and allowed to go to waste. He estimates the annual loss of ammonia thus wasted to be not less than 130,000 tons, which, at 18*l.* per ton, would represent a money value of 2,340,000*l.* (or over $11,500,000.) annually thrown away. In addition to this, the tar allowed to go to waste in the same way amounts to half that sum, which swells the annual loss to the enormous sum of more than three and a half million pounds sterling. The loss does not stop here; for, as Dr. Smith proceeds to show, ammonia being a valuable fertilizing substance, it follows that, if the amount wasted, as above noted, were saved and properly applied, it would yield an increase of eight millions at least. At Bessages, in France, he says, where coke-burning is practiced, all the gases are utilized in the process, showing that the saving of these valuable elements is practicable. The same reproach may properly be cast upon the manner in which the manufacture of coke is carried out in this country.

THE VELOCITY OF LIGHT.—Prof. Pliny E. Chase has made a calculation of the velocity of light, which tallies very closely with the values found by former observers. Concerning his method, we can do no more here than simply give his statement that "the late experiments of Michelson, and those upon which Newcomb is now engaged, may lend interest to approximations to the velocity of light by the nebular hypothesis." He has found, by his method of computation, the value 299,090 kilometers (185,435·80 miles) per second. The close accordance of the values for this constant found by various physicists pursuing different methods of experimentation to reach the result is quite noteworthy. For example, the velocity of light as determined by

Foucault is	298,000	kilometers.
Cornu	300,000	"
Perry and Ayrton	298,000	"
Michelson	299,820	"
Chase (1)	298,030	"
" (2)	299,090	"

To convert these values into miles, multiply by 62. For further details of Prof. Chase's method, consult *Journal Franklin Institute*, January.

THE WONDERFUL ADAPTABILITY OF PAPER.—The adaptability of paper to numerous important and widely varied uses is wonderful. What other substanee can be satisfactorily substituted for wood, iron, and such common materials, to the extent that paper can be? It is impossible to find anything else which, like paper, may be so differently and so dexterously prepared, as regards flexibility, thinness, strength, durability, imperviousness to fire and water, etc., that it can be readily made into pails, washbowls, dishes, bricks, napkins, blankets, barrels, houses, stoves, wearing-apparel, curtains, bonnets, newspaper and writing sheets, wrappers, carpets, coating for iron ships, flower-pots, boxes, parchment-slates, coverings for the leads of pencils, jewelry, lanterns, car-wheels, dies for stamping uppers of shoes, roofing, and many other things. It is this tendency on the part of paper to take the place of everything else, to become a universal substitute, so to speak. which leads to the conclusion that the future has a grand development in store for it, and that in years to come its manufacture will hold a magnificent position among the great industrial interests of the world.—*Chicago Journal of Commerce.*

CONCRETE FOUNDATIONS.—The strength of concrete to withstand the strain caused by heavy moving loads has been shown by the experiments with a 100-ton gun which were conducted at the Woolwich marshes on Monday. A temporary fortification on which the gun was mounted has been constructed of concrete on the marshes adjoining the Arsenal, the part below ground consisting of cement and Thames ballast, and the upper part of cement and crushed furnace slag. The parapet is ten feet high. About three thousand tons of material were used. The gun was loaded with a charge of 425 lbs. of pebble powder and a projectile about three feet long, which weighed nearly a ton. It is, perhaps, difficult to imagine the effect of the firing of such a mass, but although the vibration of the ground was evident, the concrete fortification remained uninjured. Whether concrete could resist a cannonading as well as masonry has yet to be determined.—*The Architect.*

THE VOLGA BRIDGE.—A large undertaking has recently been completed in Russia in the shape of a long bridge over the Volga, on the Syoran and Orenberg Railway, connecting the cities of Syoran in the government of Simbrisk with that of Samara. The width of the river is nearly a mile, and as it is liable to the occurrence of very heavy spring floods, the piers (of which there are fourteen altogether) had to be built 100 feet above mean water level, the depth of the river being more than fifty feet. The girders, 364 feet long and twenty feet wide, were all riveted and put together on the right bank of the river, and then floated to their position. The whole cost of the bridge was 7,000,000 silver roubles; and it is worthy of mention that it was completed without any loss of life or any accident of importance.

CEMENTS.

It is one of the popular errors of the day to suppose that the mortars used by the builders of former centuries were more enduring than those of the present age. Such is not the case, and no proof of it is furnished by any existing or historical evidence. The ancients used bitumen for cementing together bricks and stone in their masonry construction. Bitumen was used in building the Tower of Babel, and the walls of Babylon were composed of bricks united together with hot asphaltum. An analysis of some of the mortar taken from one of the Pyramids shows that the Egyptians used a mixture of lime and sand, proportioned about like the common lime mortar of the present day. The aqueducts of ancient Rome were built with a mortar of a similar character. A step in advance was the use of the Italian pozzuolanas, or volcanic ashes, a material which has been extensively employed throughout Italy and some parts of France, from the times of Pliny and Vitruvius down to the present century. In the Netherlands, what is known as Dutch trass, a material made from a soft rockstone, and in its properties closely resembling the Italian pozzuolanas, has long held an important place among building materials. Until about the beginning of the present century this class of materials, comprising, besides those above named, some of the ocherous earths, granites, schists and basalts, various sands, and sometimes furnace slags and burnt clay, were depended upon throughout the civilized world for conferring, in a feeble degree, the hydraulic property upon mortars.

The discovery of the natural cements was a second step in advance. That event was regarded at the time as only the re-discovery of a lost art, and hence to the article first produced was given the name of Roman cement, a name now generally applied to all natural, quick-setting cements. The Roman, or natural, cements gave such satisfaction that attempts to manufacture them, by burning an artificial mixture of chalk and clay, soon followed, finally culminating in the production of what was called Portland cement, which has been in general use from that time to the present, and which is now manufactured extensively in England, on the Continent and in the United States. With Portland, or hydraulic cement we are able to produce a mortar of greater strength and hardness than any that the researches of antiquarians have ever brought to light. The examples we have of ancient masonry are restricted mainly to aqueducts, sewers and other subterranean works that have not been exposed to the disintegrating action of the elements. Nearly all the specimens extant have been found accompanied by conditions extremely favorable to their indefinite preservation. Mortar made with the hydraulic cement of the present day possesses, when but a few months old, more of the acknowledged characteristics of durability than anything that has ever been discovered.

Roman, or natural, cements usually take the name of the place of manufacture. They are produced by burning, at a heat just sufficient in intensity and duration to expel the carbonic acid, certain argillaceous or silicious limestone, containing less than 77 per cent. of both carbonates, and afterward grinding the product to a fine powder between millstones. They can be produced artificially by burning a mixture of lime, or carbonate of lime, and clay. Prior to the discovery of the process for making Portland cement, Roman cements were made in both France and England, by slightly varying the proportions of the ingredients and burning the mixture at a high heat. The superior qualities of Portland cement, however, and its greater economy, gradually drove these quick-setting artificial cements from the market. Their manufacture soon ceased, and has never been resumed. But it is not to be expected that the use of these natural cements will be entirely superseded by that of the Portland. For certain purposes they are as necessary, not to say indispensable, at present as they were when their introduction revolutionized the former methods of executing submarine constructions in masonry. They possess sufficient strength for the purposes to which they are usually applied, viz., for massive concrete foundation, for the concrete hearting and backing of thick walls faced with brick or ashlar, and as the means of conferring the hydraulic energy upon mortar for ordinary stone and brick masonry. Nevertheless, it is true that for similar purposes good Portland cement, suitably diluted with common lime, in order to reduce it to the strength of the quick-setting natural cements, is in most localities the less costly of the two. Portland cement produces a mortar possessing about four times the strength, at less than twice the cost, of the quick-setting artificial cements.

For concrete foundations laid green in water, Roman cements are almost invariably to be preferred, in the hands of ordinary workmen, to those which set more slowly. Most of them not only hold the sand, by their unctuous and adhesive properties, more tenaciously than the Portland cement, but their prompt induration or hardening arrests the washing effects of the water, and prevents the progressive separation of the sand and cement before it has had time to proceed far enough to produce serious injury to the concrete.

Portland cement was named from its resemblance in color to the English Portland stone. In contradistinction to the Roman, or natural, quick-setting cements, it is described as a heavy, slow-setting cement, produced at a high heat. There are several processes in use for making this cement, dependent in some measure, so far as they differ from each other, upon the locality and the special characteristics of the materials employed. In general terms, Portland cement is produced by burning, with a heat of sufficient intensity and duration to induce incipient vitrification, certain argillaceous limestones or calcareous slags, or an artificial mixture of carbonate of lime and clay, or lime and clay, and then reducing the burnt material to powder by grinding. This cement was discovered and first manufactured in England, soon after the beginning of the present century. Factories were shortly established in certain districts of France and in other parts of the Continent of Europe. The United States being plentifully supplied with the argillo-magnesian, and to some extent with the argillaceous limestones, suitable for making Roman cement of good quality, and having had a large capital invested in this industry since about 1830, were slow to adopt the Portland cement. It was not until after the close of the civil war that the importation of Portland cement received any encouragement. It was first used here upon government works, and afterwards in the manufacture of artificial stone. Its consumption soon, however, assumed large proportions. In the years 1874 and 1875, the importations amounted to 100,000 barrels of 400 pounds each year. Since that period, Portland cement works have been started in different parts of this country, and have supplied the home demand to such an extent that the importation of foreign Portland cement has very much fallen off. It is probable that in a short time very little, if any, Portland cement will find a market in the United States except upon the Pacific coast, where it will be procured by direct importation.

SECULAR CHANGES IN THE EARTH'S FIGURE.

An interesting hypothesis has been promulgated before the French Academy by M. Faye. It has long been known from geodetic surveys and pendulum experiments that continents and mountain ranges do not exert this attraction on the pendulum which might be expected of them, judging from the observed attraction of such isolated masses as Mount Schehallion in Scotland, or the great pyramid. In fact the deficiency of mountains in this respect is so striking that in order to account for it, geologists and astronomers have imagined that there are vast cavities underlying continents and mountain chains. A somewhat different explanation on the feeble action of the Himalayas on the pendulum has been offered by Sir George B. Airy, who supposes that the attraction of the mountains is counteracted by still fluid lakes of rock below them. But this suggestion does not meet the fact, elicited by M. Saigey, that the attraction on islands of the sea is greater than it ought to be. It appears to be clear, however, that there is a relative lack of matter under continents, and an excess of it under the oceans. The hypothesis of M. Faye would seem to solve the problem in a very simple and reasonable manner. He holds that under the sea the earth's crust has cooled much more quickly than under dry land, and hence the solid sea-bed is denser and thicker than the sub-continental mass. Water is a good conductor of heat as compared with rock, and being liquid it is also able to convey heat from its underlying basin. Geodesy shows that the present figure of the earth is an ellipsoid of revolution ; but if M. Faye's hypothesis is correct it has not always been so. At first it was an ellipsoid, but the unequal cooling of the earth due to the liquid mantle covering it, led to unequal stress and the elevation of continents where the crust was thinner. These continents according to M. Faye, surrounded the north pole, and the level of the ocean over our hemisphere was raised ; thus bringing the earth to a more spheroidal form. Finally, as the cooling continued, the austral continents attracted the oceans and the figure became once more ellipsoidal as it is to-day. If this ingenious speculation were the true one, it would unquestionably help geologists to explain the origin of the glacial period. *Engineering.*

THE Chinese workmen introduced by the manufacturers of North Adams, Mass., are leaving the place, many of them returning to China.

NEVADA'S NATURAL PHENOMENA.

Nevada is a land of curious natural phenomena. Her rivers have no visible outlet to the ocean. She has no lakes of any magnitude. She has vast stretches of alkali deserts, however, that give every indication of having been the beds or bottoms of either seas or lakes. Down in Lincoln county there is a spring of ice-cold water that bubbles up over a rock and disappears on the other side, and no one has been able to find where the water goes. At another point in the same county is a large spring, about twenty feet square, that is apparently only some eighteen or twenty inches in depth with a sandy bottom. The sand can be plainly seen, but on looking closer it is perceived that this sand is in a perpetual state of unrest. No bottom has ever been found to this spring. It is said that a teamster, on reaching this spring one day, deceived by its apparent shallowness, concluded to soak one of his wagon wheels to cure the looseness of its tire. He therefore took it off and rolled it into the, as he thought, shallow water. He never laid his eyes on that wagon wheel again. Our mountains are full of caves and caverns, many of which have been explored to a great distance. Speaking of caves, a redeo was held last spring over in Huntington valley. During its progress quite a number of cattle were missed and for a time unavailing search was made for them. At last they were traced to the mouth of a natural tunnel or cave in the mountain. The herders entered the cave, and following it for a long distance, at last found the cattle. It appears that they had probably entered the cave, which was very narrow, in search of water. It had finally narrowed so that they could proceed no further. Neither could they turn around to get out. They had been missed some days, and if they had not been found must inevitably have perished in a short time. As it was they were extracted from their predicament with difficulty, by the herders squeezing past and getting in front of them and scaring them into a retrograde movement by flapping their hats into the faces of the stupid bovines.—*Eureka Leader.*

PERTINENT FACTS ABOUT EATING.

In a recent number of the London *Standard* under the query, "do we eat too much?" the writer gives many interesting facts. He says, for instance that the amount of nourishment which a person needs greatly depends on his constitution, state of health, habits and work. A sedantery man requires less than one whose duties demand the exercise of his muscles, and a brain-worker needs more than an idler. But unquestionably the majority of us take more then we need. Indeed, food and work are distributed most unequally. The man of leisure is also the man of means, and accordingly fares sumptuously every day; while the laborer toils for eight hours, and finds it difficult to get enough to repair the waste of his tissues. Yet a Chinaman or a Bengalee will toil under a tropical sun, and find a few pice worth of rice or jowrah sufficient to sustain his strength. A Frenchman will not eat half what an Englishman engaged in the same work will demand, and a Spanish laborer, content in ordinary times with a watermelon and a bit of black bread, will toil in the vineyards and grow fat on a dietary of onion porridge and grapes. It is true that Mr. Brassey, when building the Continental railways, found that one English navvy was worth a couple of spare-fed foreigners. But, on the other hand, the British Columbian and Californian gold-diggers, than whom a more magnificent set of athletes does not exist, live in the remote mountains of the Far West mainly on beans flavored with a few cubes of pork. But they also obtain the best of water and the purest of air, and their out-door life and active exercise enable them to digest every ounce of their frugal fare. The English soldiers, though better fed than those of any army except the American, do not get one-half the solid nutriment which the idlest of club-loungers considers indispensible for his sustenance. An athlete in training is allowed even less food; yet he prospers on the limited fare, and prolongs his life by the regimen by which he has been subjected. King Victor Emmanuel was a monarch of the most robust physique; yet he only ate one meal per day, and it is manifestly absurd for any man to require three more or less weighty meals, and an afternoon cup of tea, to support the exertion of walking to the club, riding an hour in the park, writing a note or two, and dancing a couple of miles around a ball-room. The ancients had their "amethustoi," or "sober stones," by which they regulated their indulgences at table. The moderns have not even this. But they have their gout and their livers to warn them, when it is too late, that nature has been overtasked.

SUBMARINE OBSERVATORY AND ELECTRIC LIGHT.

The accompanying engraving taken from the *Leipziger Illustrirte Zeitung*, illustrates Bazin's submarine observatory and electric light, which has been found to be of the greatest service in examining wrecks, submarine foundations, etc. It was used for the first time in examining the wreck of the Confederate steamer "Alabama," which was sunk off the French coast at Cherbourg. The electric light is contained in a heavy cylinder, about 4½ feet high and about 4 feet in diameter, and provided with a heavy plate glass bottom. The lower part of the cylinder contains alum water to counteract the pressure of the sea water, which increases very rapidly as the apparatus is lowered. The upper part of the cylinder contains a powerful electric lamp, the light rays of which pass through the alum water and the plate glass bottom, and lights up the bottom of the sea for a space of 100 feet in diameter.

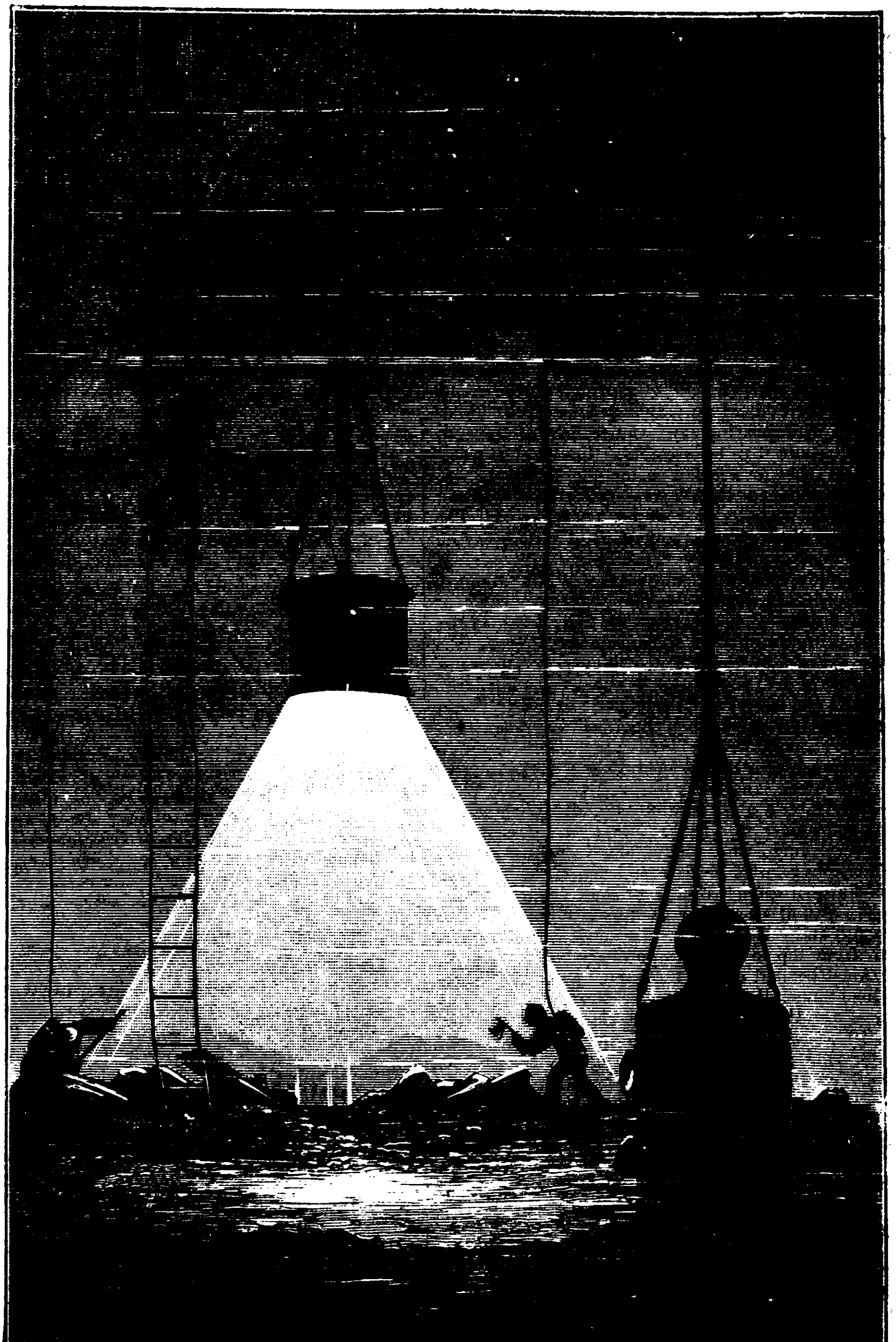
Bazin's observatory, shown in the right hand corner of the engraving, is about 9 feet high and 2 feet in diameter. It is provided with two bull's-eye windows through which the person in the observatory can watch the divers that are at work on the wreck. As the water is an excellent conductor of sound the superintendent can converse with the divers very conveniently.

A person can remain in this observatory for about three quarters of an hour, and if any parts should break or leak he can enter the upper helmet and remain in the same from eight to ten minutes, thus allowing ample time to raise the entire apparatus to the surface.

PRODUCTION OF SOUND BY LIGHT.—At the recent meeting of the American Association for the Advancement of Science, Mr. Alexander Graham Bell, well known as the inventor of the telephone which bears his name, read a paper describing some remarkable discoveries, which he had succeeded in making in connection with Mr. Summer Taintor, in effecting the production and reproduction of sound by means of light. Mr. Bell, in describing the experiments, stated that, in studying the influence of light in modifying the electrical conductivity of selenium, he had been led to the thought that the audible effects of the telephone, which are attained by the modification of the electrical current by sound-waves, could be produced by variations in the intensity of light acting on selenium, and that by suitable transmitting and receiving apparatus it would be possible to produce audible effects at a distance without the use of a connecting wire, by simply employing the affected beam of light between two stations.

Mr. Bell employs for this purpose a flexible mirror of silvered mica or very thin glass, against the back of which the speaker's voice is directed. The light undulations reflected from this mirror are affected in a manner corresponding to the sounds. Mr. Bell uses a concentrated beam of sunlight, which is received at a distant station on a parabolic mirror, in the focus of which is placed a selenium cell connected in a local circuit with a battery and telephone, and has succeeded so far in his experiments as to be able to transmit messages along a beam of light over a distance of 800 feet. In the present stage of these highly important experiments, it is impossible to state to what distance a message may be sent; but when we remember that by means of the heliograph telegraphic messages have been flashed from station to station over a distance of nearly 50 miles, it is not improbable to suppose that when the apparatus—called the photophone by its inventors—shall have been perfected, audible messages may be exchanged between stations as far apart as a beam of light can be sent. Not the least important of the observations made in this connection by Messrs. Bell and Taintor is the discovery that selenium is not alone in being sensitive to light-vibrations, but that quite a number of metallic and other substances share this property with it. Mr. Bell summarized his results in the following statement: We find that when a vibratory beam of light falls upon thin substances, they emit sounds, the pitch of which depends upon the frequency of the vibratory change in the beam of light. We find further, that when we control the form or character of light-vibrations on selenium, and probably on the other substances, we control the quality of the sound, and obtain all the varieties of articulate speech. We have not had an opportunity of testing the limit to which this photophonic influence can be extended, but we have spoken about 800 feet apart, and there seems no reason to doubt that the results will be obtained at whatever distance a beam of light can be flashed from one observatory to another.

IT is said that the Hamilton Felt Hat factory, which has been languishing for some years past, is to resume operations at an early date.



SUBMARINE OBSERVATORY AND ELECTRIC LIGHT.

Painter's Work.

PANEL PAINTING.

Select woods for water color painting that are close of grain and texture. Ebony is the best, but as that is expensive, mahogany stained black is generally used as a substitute. Pear, mahogany, cedar and oak are all suitable. Greywood, which is merely white wood steeped in mineral water, can be employed as panels most effectively when decorating rooms where the general coloring is subdued in tone. Have choice and good close wood; see that it is smoothly planed and remove any splinters or raw edges, with fine sandpaper; also be careful that the grain of the wood runs length ways and is straight. Commence by sizing your panel with either a coating of patent size, or with two of isinglass that has been dissolved in hot water. The sizing prevents the water colors from sinking into the wood and losing their brilliancy, and also checks the paint running and becoming ragged at its edges. When the size is dry, draw the outline of your painting upon the wood. The best plan for this is to make your sketch upon a piece of paper and perfect it upon that and then trace it upon tracing paper and transfer it to the wood by putting blue or red carbonized paper between it and the panel and going over the outline with a fine pointed pencil.

Should you be working upon dark wood, fill in the whole of your design with Chinese white before attempting to color it, and this is also a good method when painting upon light woods should you wish an illuminating appearance given to your design or desire to execute it in body colors. The Chinese white should always form the foundation color for facing leaves, grasses, etc., as the subdued tints necessary for these will not stand out upon wood without the under white paint. The Chinese white will also destroy any irregularities of surface caused by the grain of the wood; but many think it an improvement to the painting to allow the veins and marks in the wood to show. Paint as in ordinary water-color painting, but make your highest lights and deepest shadows brighter than usual, as the varnish will diminish the brightness of the coloring, so that it is better to slightly exaggerate the effects. Never work over a color until it is perfectly dry, and stipple in the deepest shadows. Should the colors not run freely, add a very little oxgall to them, but this medium is rarely needed when the wood has been properly sized.

Glaze with a thin wash of a lighter color over a dark to give brilliancy to your painting, and mark out veins of leaves after they are finished by laying a foundation of Chinese white and putting the light color over it. Faded leaves and grasses improve a painting very much, and should always be used when possible; they should be painted as if in the background. When your painting is finished leave it to dry for some days, then size it with two coats of patent size (allow the first coat to dry before applying the second) and varnish with white spirit varnish. The sizing is put on from top to bottom, and every part gone over, and the varnish must be laid on in the same manner. White wood can be stained thus: Boil logwood for twenty minutes in enough water to cover the chips, lay it on the wood while hot, and while it is still wet apply a coating of pyrolignite of iron. When dry, repeat this process, and when again dry, put on another coating of pyrolignite of iron. Sandpaper your surface with a fine paper until it is perfectly smooth; dust away the sand and varnish, mixing lampblack with the varnish if you want a dull black surface. If you do not wish to varnish your wood but wax polish it, lay wax and turpentine upon it, and leave for twenty-four hours, then rub the surface smooth with pieces of cork.

On this subject another writer says: "Another plan is to cover the empty spaces with gold paper; when so doing size the door before putting on the paper, as then it will be sure to adhere firmly, and only use the best gold paper, as the cheaper sorts will tarnish and soil. A set pattern, painted in water colors upon the gold, is a great addition to its beauty, and gives a good "framing" to the pictures. Two or three colors only should be used about the border; body colors are the most effective, but either kind can be used. They should be mixed with water color size to make them adhere to the gold paper. The most lasting finish of all is oil color. Select two shades of a color, that will contrast with your pictures and look well with the rest of the room, and mix half a pound of each color. Should you wish the color to dry flat and unshiny, have more turpentine than oil mixed with the paints, and paint on your color as soon as mixed, or the turpentine will evaporate. As your door is already painted, there will be no difficulty in applying another coat. Only paint round your pictures, dividing your spades into half, and putting your lightest shade nearest your pictures, your darkest as an outside border. Wash your brushes in turpentine, and then in soap after using them."

Velocity of Projectiles in Guns.—The methods that have been tried for ascertaining the law of motion of a projectile in the bore of a gun (with a view to finding the law of pressures developed) give only a small number of points of the curve of spaces traversed in given times, and they involved perforation or other injury to the walls of the gun, so that they are applicable only to large pieces. A new and ingenious method, advantageous in these respects, has been contrived by M. Sebert. In the axis of a cylindrical hollow projectile he fixes a metallic rod of square section, which serves as guide to a movable mass. This mass, or runner, carries a small tuning-fork, the prongs of which terminate in two small metallic feathers, which make undulatory traces on one of the faces of the rod (blackened for this purpose with smoke) as the runner is displaced along the rod. The runner, it will be understood, is situated at first in the front part of the projectile, and while the latter is driven forward remains in place, the rod of the projectile moving through it. The escape of a small wedge between the prongs of the fork at the moment of commencing motion sets the fork in vibration. It can be easily shown that, owing to the very high speed imparted to the projectile, the displacement in space of the inert mass, through friction and passive resistances, which tend to carry it forward with the projectile, is such as may be quite neglected, so that the relative motion of the mass recorded by the tuning-fork may be considered exactly equal and opposite to the motion of the projectile. A study of the curves produced guide to the laws of the motion and of the pressures developed by the charge. Evidently the motion of a projectile as it buries itself in sand or other resistant medium may be similarly determined.

The Late Benjamin Ferrey.—Mr. Benjamin Ferrey, who died in London recently in his seventy-first year, was one of the most eminent agents in the early days of the Gothic revival. As a church architect he has not been excelled, and many of his buildings have the grace of ancient examples. Mr. Eastlake wrote in 1872:—"His architectural taste was for years in steady advance of his generation, and as an authority on church planning and general proportions he had scarcely a rival. His work possessed the rare charm of simplicity, without lacking interest. By the use of carefully studied mouldings, and a spare but judicious introduction of carved ornament, he managed to secure for his buildings a grace that was deficient in many contemporary designs, which had been executed with far more elaborate decoration and at greater cost. His country churches are especially notable for this reticent quality of art."—*The Architect.*

—The utilization of old vulcanized caoutchouc is effected by Heyer, of Berlin, in the following way:—Old used-up buffer-rings of railway carriages are heated, in presence of steam; the sulphur distils off, the caoutchouc melts and flows in hot water, collecting at the bottom of the vessel. The steam prevents burning of the material. The melted caoutchouc has essentially different properties from what has been supposed. It becomes a pretty thin, dark mass which remains liquid even at ordinary temperature, soon dries in air, and retains its property of being water-tight. On the other hand, it parts with its elasticity, at least for large pieces. Heyer uses this liquid caoutchouc chiefly for making water-tight coverings for road or railway carriages, awnings for ships, &c. It is recommended also as a water-tight varnish for iron wares.

How to Use Oil-Stones.—Instead of oil, which thickens and makes the stones dirty, a mixture of glycerine and alcohol is used by many. The proportions of the mixture vary according to the instrument operated upon. An article with a large surface, a razor, for instance, sharpens best with a limpid liquid, as three parts of glycerine to one part alcohol. For a graving tool, the cutting surface of which is very small, as is also the pressure exercised on the stone in sharpening, it is necessary to employ glycerine almost pure with but two or three drops of alcohol.

Preserving Leather.—To preserve leather hose, belting, etc, in good condition, use crude castor oil, warmed if possible, and freely applied. It increases the pliability of the leather and the cling of the belts, and does not become rancid. Rats avoid it. In hose it should be pumped in from the interior under considerable pressure, thus thoroughly filling the pores.

CAUSES OF THE PRESENT FIGURE OF THE EARTH.

The *Comptes Rendus* of the French Academy contains a remarkable paper by M. Faye on the physical forces which have produced the present figure of the earth. After remarking on the use of the pendulum in determining the figure of the earth from series of measurements of the intensity and direction of the gravitation force at different parts of the earth's surface, he draws attention to the very curious fact that while the direction and intensity of gravity and affected perceptibly by the presence of hills such as Schichallion and Arthur's Seat, or even by masses as small as the great pyramid of Gizeh, gigantic mountains such as the Himalayas, and great elevated plateaux and table lands, do not affect the pendulum indications in any sensible manner, except in certain cases where upon elevated continents there appears to be a veritable defect of attraction instead of the excess which might be expected. Indeed, the observations are sufficiently striking to seem to point to the supposition that not only under great mountain, but even under the whole of every large continent, there were enormous cavities. More than this, the attraction at the surface of all the great oceans appear too great to agree with the distribution presumed by Clairant's formula, which is exact enough for most purposes. Sir G. Airy's suggestion that the base of the Himalaya range reaches down into the denser liquid interior, and there displaces a certain amount of that liquid, so that the exterior attraction is thereby lessened, is one which, inherently improbable, fails to have any application in explaining why the attraction above the seas should be greater than over the continents. M. Faye propounds the following solution to the difficulty: "Under the oceans the globe cools more rapidly and to a greater depth than beneath the surface of the continents." At a depth of 4,000 meters (18,000 feet) the ocean will still have a temperature not remote from 0° C., while at a similar depth beneath the earth's crust the temperature would be not far from 150° C. (allowing 108 feet in depth down for an increase of 1° in the internal temperature). If the earth had but one uniform rate of cooling all over it, it would be reasonable to assume that the solidified crust would have the same thickness and the same average density all over it. It is therefore argued that below the primitive oceans the earth's crust assumed a definite solid thickness before the continents, and that in contracting, these thicker portions exercised a pressure upon the fluid nucleus tending to elevate still further the continents. This hypothesis, M. Faye thinks, will, moreover, explain the unequal distribution of land and sea around the two poles, the general rise and fall of continents being determined by the excess of density of the crust below the oceans, and by the lines or points of least resistance to internal pressure being at the middle of continents or at the margin of oceans.

THE CAUSES OF TERRESTRIAL MAGNEETISM.

In his memoir entitled "Theory of Electric Phenomena," Mr. Edlund has explained the galvanic effects by a current of ether in the circuit, and the electrostatic phenomena by condensations and rarefractions of this ether. If this explanation is correct, then it follows that an insolating body moving with a celerity similar to that of the ether in a galvanic current must produce the same phenomena. To verify this idea Mr. Selim Lemström has constructed a paper tube with two concentric walls, which can be rapidly moved round a cylinder of soft iron which is freely suspended in the direction of the vertical axis of rotation. In employing a pair of astatic needles furnished with a mirror and suspended on a very fine silver thread, this gentleman has succeeded in ascertaining that this double-walled paper tube acts like a galvanic current and magnetizes the soft iron cylinder in the one or the other sense according to the direction of the rotation.

According to the geologists, the crust of our earth has two per cent of iron, and supposing that all the magnetic molecules are concentrated in one layer forming the inside of this crust, then this crust of magnetic matter would have the thickness of about 1 kilom. (five-eighths of a mile). This magnetic layer, which is about 30 kilom. (18·75 miles) below the surface, having nearly the shape of a sphere, may be considered, as regards its magnetic effect, as a real sphere when influenced by a certain force.

The earth being a magnetic body, suspended in the ether and turning around its own axis, will, from a magnetic point of view, be magnetized in the same way as if it were itself at rest, while the ether would move around it in an opposite direction. Going out from this theory, after finding by calculation the force which guides this molecular magnet following the axis of the earth, and after ascertaining the magnetic momentum, we have mathematical values which, corresponding to the formula of Gauss, explain the position of the magnetic axis of the earth, as well as its secular, annual, and daily variations, and which are in perfect accordance with the accidental phenomena, such as magnetic tempests and the aurora borealis.

Another Addition to the Dangers of the Ocean Passage, which is generally overlooked in the consideration of the perils that beset those who go down to the sea in ships, was shown to exist in very serious reality by the explosion that took place on the passenger steamship *Greece*, just arrived from England, and about entering her dock. The descent of one of the hands with a lighted lantern into the hold, to unfasten the hatches, caused an explosion of coal-gas that had been generated during the voyage in the confined space, without opportunity to escape, by reason of a want of adequate provision for ventilation ; and the result was the loss of five lives and the serious injury of seven persons. Unfortunate as the accident was, it would have been far more serious had the explosion occured a little after the vessel had made fast to the pier. The immediate cause of the accident is, we think, very properly ascribed to the practice of the English owners of steamers of taking on coal enough on the other side to carry them back again. The danger attending the carrying of bituminous coal on long voyages, even where every precaution is taken to guard against their spontaneous combustion, or the generation and accumulation of explosive gases, has been so frequently domonstrated that it is time that the rule should be adopted and strictly enforced—at least with steamers engaged in the carrying of passengers—that, in addition to being required to take the well-known precautions respecting the proper mode of storing and ventilating their coal supply, ocean steamers should be prohibited from taking on at one time any more than enough coal to provide for reaching the first destination where re-coaling is practicable.

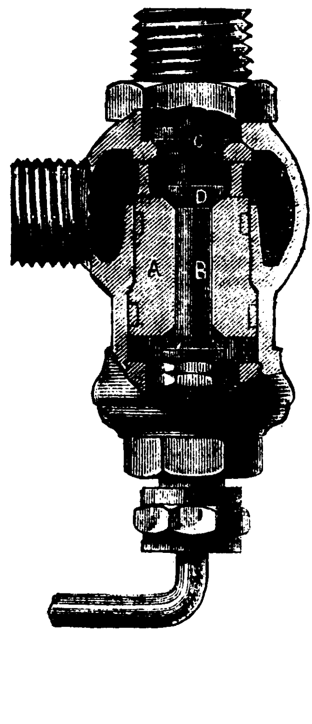
—The following case of animal intelligence has been communicated by Prof. Schutzenberger, of Strasburg, in the *Revue d'Anthropologie*. A gentleman, owning a kitchen garden, remarked that a basket which held a quantity of fresh carrots got quickly emptied. He asked the gardener who said that he couldn't understand it, but would watch for the thief. A quarter of an hour had not elapsed, when a dog was seen to go to the basket, take out a carrot, and carry it to the stable. Dogs do not eat raw carrots, so inquiry was necessary. The observers now found that the dog had business with a horse, his night companion ; with wagging tail he offered the latter the fruit of his larceny, and the horse, naturally, made no difficulty about accepting it. The gardener seized a stick, and was about to avenge this act of too-complacent good-fellowship, but his master stopped him, in order to watch further. The scene was repeated until the complete disappearance of the carrots. The dog had long made a favorite of this horse. There were two in the stable, but the other received no notice, much less carrots!

Immense Deposit of Sodium Sulphate.—The *American Journal of Pharmacy* notices the occurrence, in the Russian Caucasus, of two lakes which contain immense quantities of sodium sulphate, from which this salt is obtained in an almost pure state. The lakes have no exit, fill up in the wet season, and in summer their contents partially evaporate. The salt is obtained in layers of from a quarter to four inches thick, as it separates in consequence of cold or by evaporation in the summer. Samples that were analyzed show that the dry salt contains 95% pure sulphate, of which it has been estimated the two lakes should yield 260,000 tons. It is further said that a French company has been formed to work this deposit systematically. Of the origin of the salt our informant gives no explanation.

—An interesting fact in photography has been communicated to the Paris Academy by M. Janssen. By prolonged action of the light, which at first gives a negative image, this image disappears and a positive one takes its place having (with proper exposure), all the distinctness of the negative. In this way, by exposing plates for solar photographs, at Meudon, half a second or a second, he got images in which the body of the sun was light, and the spots dark, as seen with a telescope. (The exposure for negatives was about 1-1,000th of a second, or, in the case of plates prepared with gelatino-bromide of silver, as short as 1-20,000th of a second.) By exposure prolonged beyond the time for producing a positive image, a second neutral state is arrived at, opposite in character to the first.

AUTOMATIC SAFETY CYLINDER COCK.

The improved safety-valve and cylinder cock shown in the annexed engraving is the invention of Mr. Thomas J. Paradine, of Erie, Pa. It is capable of letting the water of condensation out of a steam cylinder without waste of steam, and is a perfect safe-guard against injury to the cylinder by an accumulation of water. The safety-valve and exit cock are arranged in a casing connected directly with the cylinder and communicating with the steam chest by a small pipe entering the lower end. The safety valve, A, has two seats in the casing, one above, the other below the lateral discharge opening of the casing, and it is pressed upwards by steam acting on its lower end, the difference in the area of the two ends being sufficient to secure this result. The valve, A, is bored longitudinally to receive a spindle, B, carrying at its upper end two valves, C, D, which are seated in the valve, A, above and below a chamber in the upper end of the valve. The lower end of the spindle, B, is also provided with a valve which has its seat on the lower end of the valve, A. The upper valve, C, is somewhat larger in area than the other valves attached to the spindle, and controls the escape of water from the cylinder. Under ordinary conditions the pressure of



steam on the lower end of valve, A, will hold it to its seat, but when an extraordinary pressure is brought to bear upon it, as for instance, when there is more in the cylinder than the clearance will contain, and the piston is just completing its stroke, the valve will be forced from its seat, and the water will escape through the lateral opening in the casing. In working regularly, when the steam is acting on the piston, it also presses the valve, C, to its seat, so that neither steam nor water can escape, but when the steam exhausts the pressure on the valve, C, is less than that on the lower end of the spindle, B, consequently the spindle is forced upward and the valve, C, is opened, allowing the water to escape. When steam is shut off from the engine, the valve, A, will drop of its own gravity and allow all the water in the cylinder to drain out. Two circumferential grooves formed in the valve, A, are filled with wicking or other packing to prevent grit from working into and around the valve. The working of this valve is entirely automatic, and it is claimed by the inventor that it is less expensive and more durable than ordinary cylinder cocks. The inventor informs us that he has had this valve at work on a pair of large engines day and night for fifteen months without once failing or showing signs of wear.

HOW THE PYRAMIDS WERE BUILT.

Brugsch Bey, the eminent Egyptologist, says, in his work on Egypt:

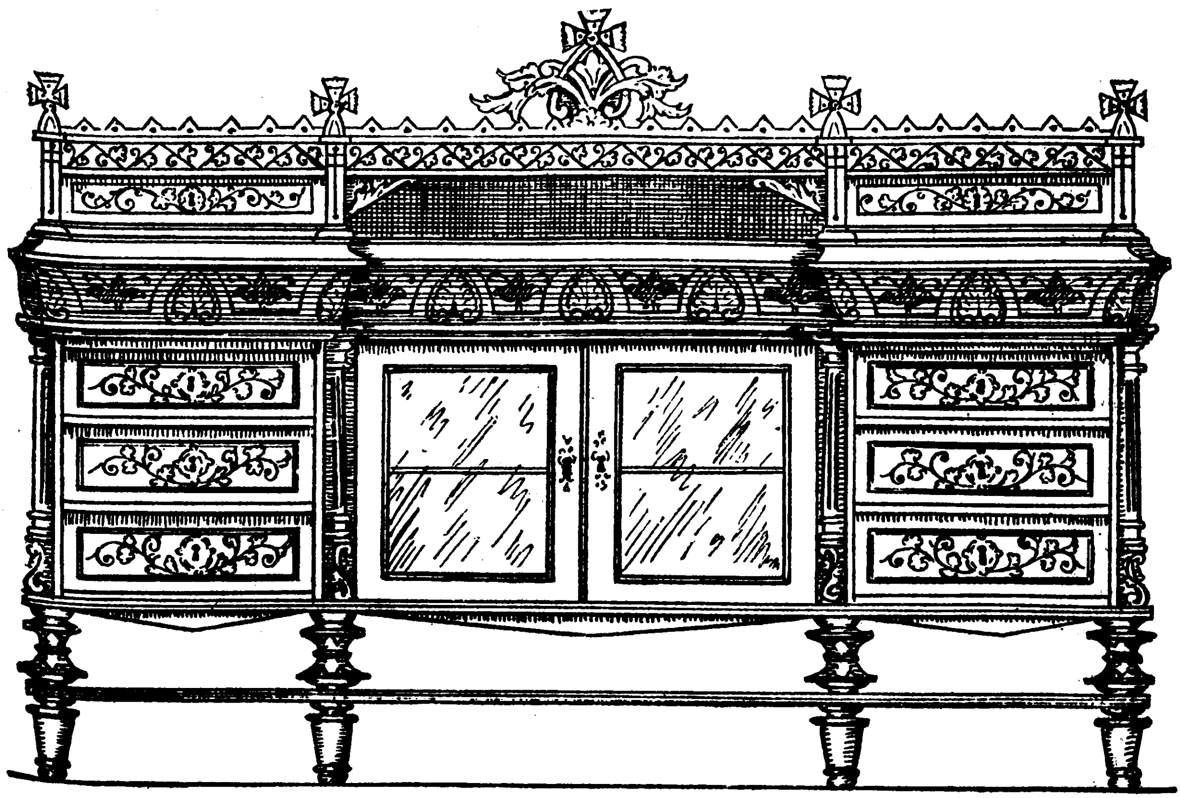
From the far distance you can see the giant forms of the pyramids, as if they were regularly crystallized mountains, which the ever-creating nature has called forth from the rock, to lift themselves up toward the vault of heaven. And yet, they are but tombs, built by the hands of men, which have been the admiration and astonishment alike of the ancient and modern world. Perfectly adjusted to the cardinal points of the horizon, they differ in breadth and height, as is shown by the measurements of the three oldest, as follows: 1. The Pyramid of Khufa—height, 450·75 feet; breadth, 746 feet. 2. Pyramid of Khafra—height, 447 5 feet; breadth, 690·75 feet. 3. Pyramid of Menkara—height, 203 feet; breadth, 352·78 feet.

The construction of these enormous masses has long been an insoluble mystery, but later generations have succeeded in solving the problem. According to their ancient usages and customs, the Egyptians, while they still sojourned in health and spirits, were ever mindful to turn their looks to the region where the departing Ra took leave of life, where the door of the grave opened, where the body, well concealed, at length found rest, to rise again to a new existence, after an appointed time of long, long years, while the soul, though bound to the body, was at liberty to leave the grave and return to it during the daytime, in any form it chose. In such a belief, it was the custom betimes to dig the grave in the form of a deep shaft in the rock, and above this eternal dwelling to raise a superstructure of sacrificial chambers sometimes only a hall, sometimes several apartments, and to adorn them richly with colored writings and painted sculptures, as was becoming to a house of pleasure and joy. The king began his work from his accession. As soon as he mounted the throne, the sovereign gave orders to a nobleman, the master of all the buildings of his land, to plan the work and cut the stone. The kernel of the future edifice was raised on the limestone soil of the desert, in the form of a small pyramid built in steps, of which the well constructed and finished interior formed the king's eternal dwelling, and his stone sarcophagus lying on the rocky floor. Let us suppose that this first building was finished while the Pharaoh still lived in the bright sunlight. A second covering was added, stone by stone, on the outside of the kernel; a third to this second, and to this even a fourth; and the mass of the giant building grew greater the longer the king enjoyed existence. And then, at last, when it became almost impossible to extend the area of the pyramid further, a casing of hard stone, polished like glass, and fitted accurately into the angles of the steps, covered the vast mass of the sepulchre, presenting a gigantic triangle on each of its four faces.

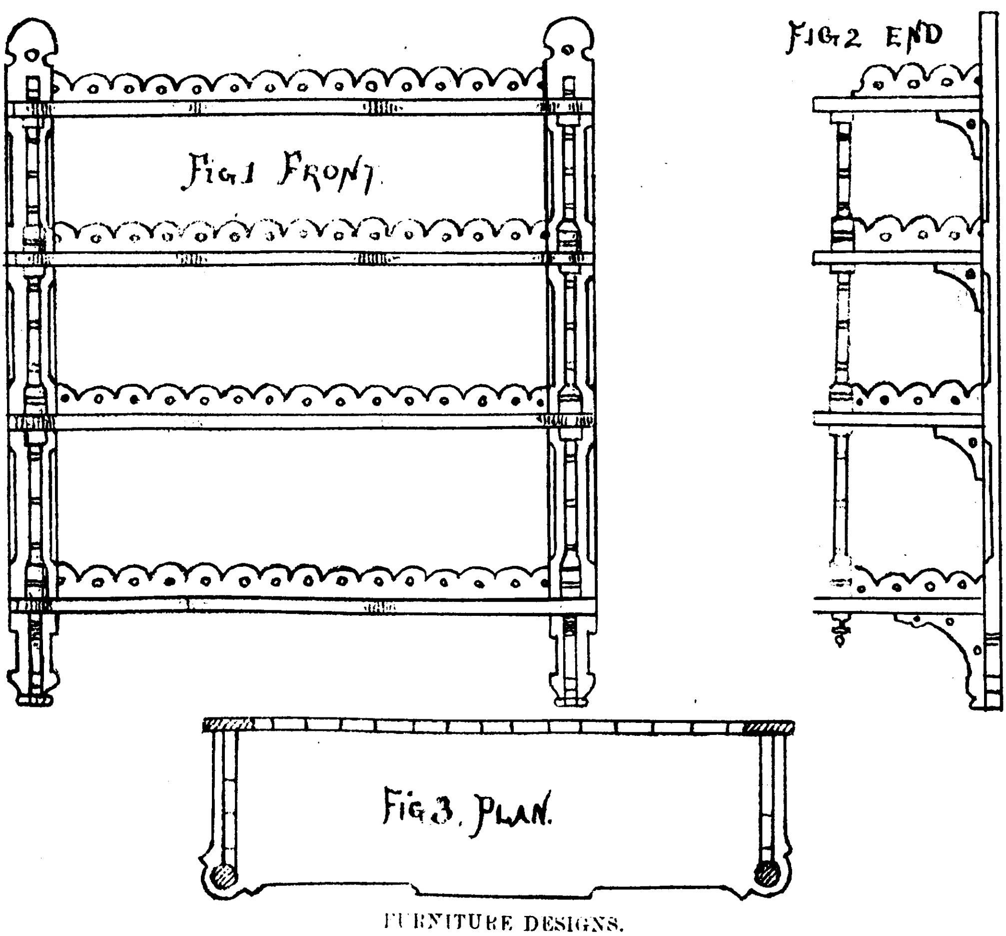
More than seventy such pyramids once rose on the margin of the desert, each telling of a king of whom it was at once the tomb and monument. Had not the greater number of these sepulchres of the Pharaohs been destroyed almost to the foundation, and had the names of the builders of these which still stand been accurately preserved, it would have been easy for the inquirer to prove and make clear by calculation what was originally, and of necessity, the proportion between the masses of the pyramids and the years of the reigns of their respective builders.

A Table Land Across the Gulf Stream.—In a recent dredging expedition from Charleston, S. C., across the gulf stream, Commander Bartlett, of the United States Coast Survey steamer *Blake*, was surprised to find the depths much less than he expected. This induced him, although the trip was one primarily for dredging, to extend the work of sounding; and he accordingly ran a line of soundings nearly along the warmest band of the gulf stream, commonly called the axis of the stream, for a distance of 150 miles from latitude 32° to latitude 33° 30' north, on which he obtained depths varying from 233 to 450 fathoms, where it was supposed that the depths would range from 600 to 1,000 fathoms. At the northeast end of this line, in about latitude 33° 30' north, the depth suddenly increased, in a distance of 15 miles, from 457 to 1,386 fathoms. These depths obtained by Commander Bartlett appear to indicate that a submarine table land may extend from the coasts of North and South Carolina across to the northern Bahamas. The development of this table land Superintendent Patterson proposes to have completed next spring, when the weather will be better adapted to such work than in the autumn and winter months.

It is proposed to etablish a bending and patent wheel factory in Bothwell, Ont.



SIDEBOARD, 17TH CENTURY.



FURNITURE DESIGNS.

Scientific.

HOW HANNAY MADE HIS ARTIFICIAL DIAMONDS.

It will be fresh in the memory of some of our readers, that a few months ago a statement was made to the effect that diamonds had been artificially produced in Glasgow by a process not yet divulged, and that, having been examined by the highest chemical and mineralogical authorities, the new gems had been found to satisfy all the conditions hitherto alone supplied by the diamonds from nature's own laboratory. When, however, it became known that the new diamonds were almost microscopical, and that a gem worth $2.50 cost $25 to make, the interest in the subject somewhat diminished.

It has, however, revived on the publication by Mr. G. B. Hannay, in the recently issued number of "Proceedings of the Royal Society," of the precise method by which he obtained his startling and novel results, from which we are enabled to glean the following interesting facts, and if only as a record of indomitable perseverance against ever increasing difficulties, of scientific acumen, and of the application of the Baconian method of research, it is worthy of study. Some idea of the nature of the investigation may be obtained from the fact that out of 60 complex and expensive experiments, only 3 succeeded. Violent explosions were frequent; furnaces were blown to pieces; steel tubes burst, scattering their fragments around. On other occasions, tubes which had been carefully prepared, filled, welded, and nested in a reverberatory furnace for many hours, were found to have leaked and spoiled the experiment. "The continued strain on the nerves," writes Mr. Hannay, "watching the temperature of the furnace, and in a state of tension in case of an explosion, induces a nervous state which is extremely weakening, and when the explosion occurs it sometimes shakes one so severely that sickness supervenes."

The diamond-making experiments were started in September, 1879, when Mr. Hannay made many attempts to find a solvent for the alkali metals, sodium, potassium, and lithium. But in no instance could such a solvent be found which did not, in the gaseous state, and under pressure, unite with the alkali. Even in the case of hydrocarbons, such as paraffine spirit containing only hydrogen and carbon. Now, as we know, diamond is pure carbon; hence, when this element was set free from a pure substance, it was thought that conditions of pressure and temperature might eliminate it in the hard, crystalline, adamantine form —namely, as diamond. Glass tubes were at first employed, but although of great thickness in comparison with their bore, they were found to insufficiently strong, and were replaced by wrought-iron tubes 20 inches long by 1 inch diameter, and having the diameter of the bore half an inch. In these lithium was heated for many hours to a high temperature in paraffine spirit, and on subsequently opening the tube, carbon in a hard form was found within it. Great difficulty was experienced in getting the tubes air-tight, and eventually the open end was welded at a white heat, and by that means alone did it resist leakage. Sometimes tubes would burst with an explosion like a gun. A tube 20 inches long by 2⅝ diameter and ½ inch bore, was filled with a hydrocarbon made from bone oil, to which some charcoal powder was added in order to keep an excess of carbon in the tube. Its open end was welded, and it was heated for 25 hours with lithium. On opening it, a quantity of gas appeared and some minute pieces of hard carbon which had evidently separated out from solution. Another similar tube burst at the end of 8 hours' heating. A tube of cast iron no less than 3⅝ inches diameter, and with a bore of only ⅝ of an inch, exploded at the end of an hour with a fearful report, wrecking the furnace. Several tubes of steel also burst under the enormous pressure, at last shattering the top of the furnace. The author remarks that in nature the temperature must at one time have been much higher than anything we can produce artificially, while the pressure obtained at a depth of 200 miles below the earth's surface is greater than that which any of the materials from which we can form vessels can resist.

We come now to the great experiment which resulted in the artificial production of veritable diamonds. A tube 20 inches long by 4 inches diameter, of coiled Lowmoor iron, was bored so as to have an internal diameter of ½ an inch. Thus the central bore was surrounded by walls of iron 1¾ inches thick, and, of course, capable of resisting an enormous pressure. In the tube was placed a mixture of 90 per cent. of bone oil and 10 per cent. of paraffine spirit, together with 4 grammes (about 62 grains) of the metal lithium. The open end of the tube was welded air-tight, and the whole was then heated to redness for 1¼ hours, and allowed to cool slowly. On opening it a great volume of gas rushed from the tube, and within was found a hard, smooth mass adhering to the sides of the tube. "It was quite black," states the author, "and was removed with a chisel, and as it appeared to be composed principally of iron and lithium, it was laid aside for analysis. I was pulverizing it in a mortar when I felt that some parts of the material were extremely hard—not resisting a blow, but hard otherwise. On looking closer, I saw that these were transparent pieces imbedded in the hard matrix, and on triturating them I obtained some free from the black matter. They turned out to be crystalline carbon, exactly like diamond."

Such is Mr. Hannay's account of his discovery. Subsequent chemical and optical analysis has proved that these hard, shining crystals are in every respect true diamonds. The cost is obviously great; so also is the danger to life and property, and the great difficulties to be overcome render disappointments common. What we now want is to get vessels of a material sufficiently strong and non-porous to resist the high pressures and temperatures upon which the success of the temperature depends. What we have learned, among other things, from the brilliant researches of MM. Caillelet and Pictet, which led to the liquefaction of the so-called permanent gases, and from Mr. Hannay's experiment as described above, is that we must push the forces of nature to their utmost strain by using our most powerful mechanical devices for producing pressure, our strongest materials for resisting it, and our intensest means of producing both heat and cold.

TWO DISASTROUS HURRICANES.

A furious hurricane ravaged the Island of Jamaica on the afternoon and night of August 18, causing a vast amount of damage. The storm struck the northern side of the island, shifted to the north-eastern side, then to the south-eastern coast, whence it travelled westward. In two hours the wind increased from two miles an hour to eighty miles, and during the day the barometer fell a full inch.

Forty-three of the forty-five vessels lying in Kingston harbor when the storm broke were destroyed, and most of the shipping along the coast was wrecked. Scarcely anything material was able to withstand the force of the wind. Public buildings were demolished in an instant. The debris was whirled high into the air and conveyed to a great distance from the structure to which it originally belonged. At Raetown, for instance, a sheet of iron roofing, weighing upward of half a ton, was lifted to a height of fifty feet, rolled up like a stick of cinnamon, and was carried a distance of 130 feet from the building which it had covered. Cocoanut groves were entirely swept away, and the fruit crops in the places visited by the storm were entirely destroyed.

Wherever the cyclone struck the plantations were completely desolated. Looking inland from Port Antonio, it is said, a man can see for a distance of fifteen or twenty miles; and in the whole of that space not a growing plant, cocoanut, breadfruit, banana, cane, corn stalk, or yam vine has been left. The coffee bushes are torn and stripped of their berries. Thousands of cocoanut trees have been blown down on single plantations. The cyclone levelled hundreds of houses and churches. The reports show that in St. George District, Portland, 131 houses were wrecked, at Yallatis fifty-nine houses; in Bath District fifty houses; in the Parish of St. Catherine every church and many houses; at Newcastle twenty houses; and so on along about 200 miles of the coast. At Kingston the damage done is estimated at $600,000, and the sum total of loss by the cyclone is appalling.

Famine is feared in the districts devastated, so general was the destruction of the coffee, fruit, and food crops.

A hurricane, said to have exceeded in destructive violence the historical hurricane of 1839, swept over the islands of Bermuda, August 29 and 30. Many houses were wrecked and the entire fruit crop was destroyed. Great damage was also done to the public works, including the causeways. Many vessels in the path of the storm were wrecked, both around the islands and along the Florida coast, where the hurricane raged with great violence. The greatest loss of life attended the founding of the passenger steamship *City of Vera Cruz*, of the New York and Havana line. Of seventy passengers and crew but 13 were washed ashore alive, after battling with the sea for 24 hours or more.

—An appropriation bill passed by the U. S. House of Representatives provides for a survey of the Gulf Stream from its origin to the Sargasso Sea. The plan embraces soundings, deep-sea temperature, and observations of the currents.

A HORSE-SHOER'S EXPERIENCE.

CORNS—INTERFERING—OVER-REACHING—WELDING TOE-CALKS—COLD FITTING—A GOOD TIRE UPSETTER.

Nine persons out of ten will say that corns in horses' feet are caused by bad shoeing. My experience will justify me in saying that nine-tenths of the corns are caused by the owners of horses neglecting to get them shod as often as they ought. We are nearly all agreed that horses be should shod as often as once in every four to seven weeks, according to circumstances. Now, a great many horse-owners, particularly farmers, will get a team shod, and unless the horse becomes lame, will permit the shoes to remain on until they *grow off*.

If the horse has a round foot and the shoe was fitted close all around, in four or five weeks the shoe will have been carried forward by the growth of hoof, so that one or both of the heels will be off the wall, and in a short time corns will be produced. Now, if the owner would take his horse to the shop some fixed date every month, instead of leaving the shoes on from seven to twenty weeks, horses would have fewer corns. In shoeing I prefer a wide heel and mule the heels of the forward shoes whether they have corns or not, on horses that have flat feet.

For interfering, level the foot and fit the shoe all around close. Then mule the inside heel slightly. In winter it is a good plan to turn the outside heel-calk, as it keeps the foot out of the trough of the road.

For over-reaching I have the best success shoeing with long shoes all around. Let the heels of the forward shoes stick out an inch and the hind shoes three-quarters of an inch. As the forward foot raises the long shoe will raise enough so the hind foot will pass under, while with a short shoe the shoe will raise just enough for the hind shoe to hit the heels, causing a disagreeable clinking. I can do better and quicker work with knife and rasp than with buttress.

If the foot is grown out very long I take the cutting pliers and nip the hoof of from quarters to toe. This ensures the removal of the stubs of nails, and with a sharp knife and rasp, the foot is soon ready. I practice cold fitting, although I do not think a thick shelled foot is injured by touching it with a red hot shoe that was previously fitted. A thin shelled foot I never press with a hot shoe. Was taught to weld toe-calks on shoes first and heel up afterward, but I practice heeling shoes first and put on the toe-calk when ready to use the shoe. If you toe last there will be heat enough in the shoe after welding the calk to fit the shoe. I let the heels which are nearly cold drop on the wall of the foot and hold the toe, which is red hot an inch away from foot while fitting. After the shoe is fitted and level, harden the toe, and nail on. I know a great many advocate heating a shoe red hot after the foot is prepared and the shoe fitted and press the foot for an instant with the hot shoe. But all the advantage they claim is an equal bearing and that the shoe will be less liable to come off. Now I can with knife and rasp get as good a bearing, and with a good nail fasten the shoe so that it will stay longer than it ought.

A year ago last June I bought a Samson Tire Upsetter of Wells Bros., of Greenfield, Mass. It does its work to my entire satisfaction and has saved me many hours of hard work every week since I have had it. There is no kinking of the tire and you require no helper to work it.

COLOR-BLINDNESS.

The knowledge of color-blindness has become developed to the extent that it enters into the practical business of life; for in one State (Connecticut), at least, it governs the retention and choice of the men employed on the railroads. Lately, William Pole, an English amateur in science, and himself a victim of color-blindness has written a paper on the subject, which embraces all that is known about it. He shows just what the color-blind see. The affection is confined almost exclusively to men, although instances of it have been known in women. It is estimated that about 1 in very 25 men is defective in color perceptions. The peculiarity is assumed to be hereditary and of great antiquity, although it is only within a century that it has been definitely described.

A poor English shoemaker, named Harris, was the first to notice the defect in himself and to suspect its existence in others. His case was the subject of a paper read before the Royal Society in 1787. It was reserved, however, for the distinguished English chemist, John Dalton—author of the "New System of Chemical Philosophy" in the first volume of which he explained his atomic theory—to elaborate and generalize the facts of color-blindness. Dalton was nearly thirty years of age before he noticed his defective vision, for one day while comparing his impression of a color of a flower with that of his friends he became convinced of his visual peculiarity, and was led into its investigation. The result was the first distinct setting forth of the difference between the color-blind people of normal sight. Sir John Herschel, who became interested in Dalton's case, set him to matching various tinted skeins of silk, the result of which clearly revealed that the color-sense was lacking.

Mr. Pole was also, like Dalton, about 30 years old before he was conscious of his defective vision, and his investigations show that color-blindness presents similar general characteristics in all its subjects. He says that, "strictly speaking, Daltonism (the name sometimes given to color-blindness) has only two color impressions—yellow and blue; yet the sensations of one color-blind give him 1, pure white; 2, pure black; 3, infinite varieties of gray; 4, yellow in a great variety of intensities; and 5, combination of these with the varieties of gray; 6, blue in a variety of intensities; and 7, combination of these with the varieties of gray." Such color sensations as red, green, orange, violet, and all their combinations are unknown to the color-blind. Still the colors make upon him distinct impressions. Red, for instance, appears dark yellow, or yellow brown; pink or crimson seems simply gray or a dark blue. Green is more perplexing; yellow greens, such as predominate in nature, appears as a combination of gray and yellow; neutral greens, variety of gray; and blue greens, combinations of blue and gray. Violet appears a dark or shaded blue, and brown a mingling of yellow or gray. Mr. Pole is convinced that genuine color-blindness is past remedy. It is a constitutional defect, and is generally hereditary. There are still conflicting theories respecting this visual defect, and it is an open subject of investigation.

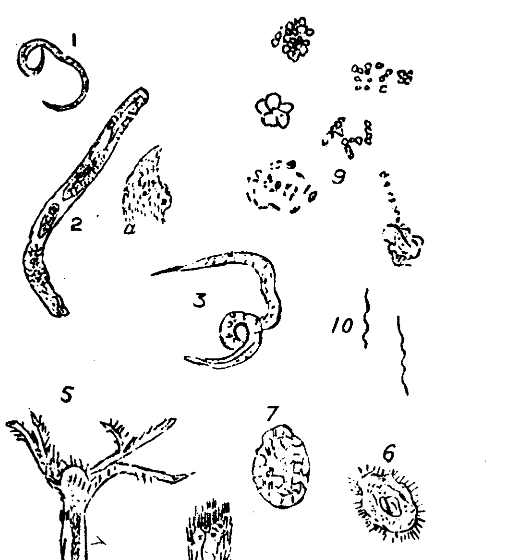
Considering the disadvantages of the color-blind in following many pursuits, Mr. Pole says it is remarkable how well they have got along. Dalton became famous in chemistry, a science in which color is one of the important elements of observation; and Mr. Pole himself succeeded as a draughtsman and colorist of drawings. His remarks on color-blindness in those employed on railroads are highly interesting. He says:

"Most people know that red and green lamps are used at railway junctions, the former to stop a train, the latter to allow it to pass on; and at sea the use of red and green lights on the two sides of a vessel indicates to other ships the way she is going, in order to avoid collisions. Now, as one of the most common symptoms of color blindness is the confounding, under certain circumstances, of red with green, it is taken for granted that a a color-blind engine driver or helmsman must be unable to distinguish between the contradictory signals, and frightful pictures are drawn of the danger that the public are constantly incurring. But what says the inexorable logic of facts? In this country we have not only had a tolerable experience of the working of railways for half a century, but we have gathered a mass of information about railway accidents which is unknown elsewhere. Every casuality that occurs in the three kingdoms is carefully inquired into by a government board, and report is published as to its causes; and yet, so far as I know, never, in a single instance, since railways have been in use, has an accident been traced to the mistaking of a red for a green night signal. And when we consider that according to the statistics, about one in every 25 engine-drivers must have been color-blind it follows that, if the notions of the alarmists had been true, numbers of collisions would have occurred every day—in fact, that the traffic of the country, could not have gone on. The truth is, the agitation has risen from the difficulty the normal-eyed investigators have in understanding exactly what we the color-blind really see. We could tell them that although the red and green lights do not give us the true red and green sensations, yet still they are strongly contrasted to us, and we are in no danger of mistaking one for the other. On the whole, then, I think the alarm on this subject is unnecessarily magnified; but at the same time I do not deny a possibility of danger under certain circumstances, and I would by no means discourage reasonable precautions in the selection of men.

It is said that the fine and various carving into which old cathedrals blossom at every corner, where a piece of fantastic ornament could find a foothold, is partly due to the interest which the workmen took in their labor. They carried home stones, and in their leisure hours wrought out whatever design seemed best to them. It thus became a labor of love.

IMPURE DRINKING-WATER—ITS SANITARY IMPORT.

The impurities contained in river water, those most likely to imperil the health of persons who drink it, are derived either from the animal or vegetable kingdoms, and are, therefore, spoken of as organic pollutions. Those of a comparatively harmless nature belong to vegetables, and may, for the present, be put aside; but all animal life, and more especially those forms drawing sustenance from existing but invisible organic matter contained in the water, and known to thrive on the contamination of sewage, must be looked upon as extremely inimical to health and life. All water collected over a highly cultivated area, land more or less heavily manured, is nearly always dangerous, since it is certain to contain a quantity of animal fæcal matter, putrescible refuse, microzymes or poison germs, elements of extreme minuteness, capable of originating special forms of disease. That these specific organisms, although they elude chemical analysis and the highest powers of the microscope, can be physically demonstrated to exist in water, for infected water placed in a glass tube and viewed in the electric beam, as proposed by Prof. Tyndall, is seen to be full of light scattering particles. Such water having been subjected to a physiological test, has unquestionably proved dangerous to animal life. At the present moment, the Thames basin drains more than two and a half million acres of land, the greater portion of which is highly cultivated and heavily manured. It might be safely predicted, then, on taking specimens from almost any part of the river, that it will contain organic impurities, in suspension and



solution. A bottle of Thames water, taken near Windsor on the 22nd of May last, abounded in various species of animal life. On making a careful microscopical examination of it from time to time, I am able to say the condition of Thames water in this respect is no better now than it was twenty years ago. On standing the bottle in the light, in a very short time a considerable sediment was deposited, consisting of vegetable, animal and mineral matters. On removing a drop with a pipette, and placing it under the microscope, numerous portions of confervæ, diatoms, decaying vegetable matter, and the outer cases of entomostraca, &c., were visible, and apparently only very few of the minuter kinds of animal life. Allowing the water to stand by about forty-eight hours, exposed to light and warmth, another dip was taken, and a higher magnifying power used, when a number of embryos were seen moving about the field, the more noxious of which were minute filiform nematode worms, Chætogasterlymnæ, Anguillula fluviatilis, Hydra fusca, Thames mud-worm, Cyclops quadricornis, Daphnia pulex, Paramœcium, pupa of culex, bacteria, &c. N w, considering how little the Thames had been disturbed by floods or rains during the previous three or four weeks of April and May, it will be admitted that this small quantity of water contained the ova and embryos of animals that together constitutes a serious contamination. The habits, or rather the natural history, of some of these creatures are well worth careful investigation. First, nematode worms. These have obtained an unenviable notoriety amongst the greatest pests of animal life. The typical form of filarian worms is the thread-worm: this affects human beings, sheep, and other ruminants, as well as several kinds of birds. There are eight or ten different kinds belonging to the genus, and some of which, like Fasciola hepatica, fluke, change their hosts once or more before attaining to sexual maturity. One species of filaria penetrates the bronchial tubes of sheep, producing a debilitating kind of cough; in lambs filarian worms accumulate rapidly in the air-passages and lungs, and a number of animals perish annually from what is called "the lamb disease." The worm is represented in Fig. 1. The much-dreaded Trichina spiralis belongs to the genus. This nematode worm derives its name from the circumstance that it was found spirally encysted in the flesh of pigs. It is usually found curled up in a spiral form in the middle of the large muscles. Before attaining to the encysted stage, it has a free existence, lives an aquatic or wandering life, and hides in moist situations or in bogs. It very closely resembles the filarian worm Anguillula fluviatilis, Fig. 3. Very many of the Anguillulidæ are parasitic upon water-snails, slugs, earth-worms, and the larvæ of insects. They are remarkable also for their tenacity of life, resisting the extremes of heat and cold. Their bodies may, by exposure to the sun's rays, be entirely dried up and immediately after the next shower of rain they will recover all their activity and vital powers; or they may be frozen in ice the winter through and survive perfectly uninjured.

Trichina spiralis infests man and numerous warm-blooded animals—the pig, dog, rabbit, rat, &c. In 48 hours after the embryos are taken into the stomach they attain to maturity. They are most active little worms, in four days are full-grown, and are then rapidly carried off by the blood-current and deposited in the muscles in almost every part of the animal's body. The nature of the fever produced by these terrible parasites is as remarkable as it is fatal. On board the reformatory ship *Cornwall*, nearly half the boys last year were suffering from what was thought to be an outbreak of enteric or typhoid fever. A death occurred, and then, on closer investigation, a large number of nematode worms were discovered in the muscles of the body. The worm was said to be trichina spiralis, which it certainly was not; it is, however, believed to be some new and undefined species. Examined under a high power of the microscope, it had the appearance of a minute, ill-formed thread-worm, of about 1-25th of an inch in length, without very definite structure. None of the worms were discovered encysted. Its possible relation to a peculiar form of enteric fever has excited a considerable amount of attention. It may be discovered, on further examination, to belong to a species of filiform worm, also found in Thames water, and named by Von Bäer Chætogaster lymnæus (Fig 2), from its having been first observed crawling over water-snails, Lymnæus and Planorbis. These worms were very numerous in my bottle of Thames-water, and soon attracted attention from their rapid caterpillar-like motion over the bodies of their host. Chælogaster lymnæus is a very translucent, thread-like whitish worm. The oral aperture is capable of a considerable amount of distention, like that of the eel. Its action is so rapid, and its body so transparent, that it is a difficult matter to trace the nervous system. It is affirmed by some observers that it feeds upon cercariæ, but I have not detected these worms in its stomach, but I have seen it filled with diatoms. Amongst other larvæ which abound in Thames water are the well-known blood-red Thames mud-worm. This worm is familiar to Londoners, as it not only finds his way into cisterns, but is so frequently ob-

1. Filarian worm; 2. Chætogaster lymnæus; 2 *a*. Enlarged head of same; 3. Anguillula fluviatalis; 4. Thames mud-worm; 5. Hydra fusca; 6. Paramœcium (engraver has made it too irregular in outline); it is nearly ovoid); 7. Egg of Culex; 8. Pupa of Chironimus viridulus; 9. Bacteria; 10. Spirilla; 11. Starch and epithelium scales. The various objects magnified from 5 to 350 diameters.

served during the summer months covering the mud-banks at low water, and imparting to the mud a deep blood-red colour. The presence of mud-worms certainly indicates a dangerous contamination: their favourite breeding haunts being the sewage-polluted mudbanks of rivers. The larvæ of the genus Culicidæ proved to be very numerous, especially that of Chironomus viridulus, Fig. 8—a very minute species of the gnat tribe. This larva, unlike most other species, builds up a brown tubular case, which it attaches to the bottom or sides of the bottle. Therein it very quietly secretes itself. In a few days' time its larval stage is completed, and it becomes transformed into the imago, and towards evening, just as the sun is declining, it quits its dwelling and floats up to the surface of the water, and, having fairly balanced itself, it spreads its gossamer wings and flies off. The head of the male is surmounted by a pair of plumose antennæ, which are long and delicate. The body is of a pale green colour, and quite destitute of scales or feathers, a well-known characteristic of culicidæ. All the gnat tribe, inclusive of the dreaded mosquito of the tropics, lurk and thrive in malarious and fever-stricken localities. The eggs of Chironomus viridulus are extremely minute, about the 1-100 of an inch in size, Fig. 7. It may be remarked of gnats, that, like vultures, they are bred amongst carrion.

As usual, small crustacea and entomostraca were found in large numbers in my specimen of Thames water—Cyclops quadricornis, Daphnia pulex, paramœcium cercomonas, &c., some of which are represented in a former woodcut (*English Mechanic*, April 30th). In warm weather, and as soon as the temperature of river-water reaches 60° Fahr., they increase with amazing rapidity, and if swallowed may produce diarrhœa and dysentery. In Boston, America, the water at one time was much infested by water-flees, and the consumers of the water suffered from fatal attacks of summer cholera. At Dorpat, Sweden, an epidemic visitation of a peculiar fever was clearly traceable to the presence of paramœcium (Fig. 6); and numerous deaths were attributed to them. Frogs, newts, and other aquatic animals have been killed by these noxious creatures. The water of the Firth of Forth is frequently seen, in summer time, deeply coloured by moving masses of minute crustaceans. To some other rivers they impart a deep red colour. The rate of increase of daphnia and cyclops is truly surprising. Such is their amazing fecundity, as estimated by the late Dr. Baird, that a single pair of Cyclops quadricornis will, in the course of six months, produce a progeny numbering four billions five hundred millions (4,500,000,000). A large number of species of entomostraca are parasitic on marine and fresh-water fish. It is contended, however, that they attack the sickly, and so make way for the "survival of the fittest." Probably this is the case, unless it be conceded that the sickness of the fish is a consequence of the presence of the parasite. Fish thus afflicted are said, by fishermen to be "lousy." These parasitic entomostraca cling, some by sucker-like processes, others by hooklets, which they bury deep in the tissues of their victims.

Thames water favours the presenee of hydroid polyps; consequently various species of hydra were found adhering to pieces of weed and decaying vegetable substances. Fig. 5 is a full-grown Hydra fusca, seen stretching out its tentacles to seize and crush prey, which it slowly swallows. These animals increase by budding, like plants, nevertheless, they possess remarkable tenacity of life, and one would not like to swallow them on the chance of their being harmless. The starch granule and epithelium, Fig. 11, are held in suspension, and nearly always form a small portion of the sediment of sewage-polluted river-water. Such bodies can in no way be estimated by chemical analysis, as they only form a minute part of any residual ash. Starch enters largely into the food of animals, and it must be assumed that this albuminoid product must have been conveyed into river-water in the excreta of animals. This, then, should be looked upon as a dangerous contamination, one which can only be detected by the aid of the microscope. Bacteria, Fig. 9, and spirilla, Fig. 10, have each acquired an unenviable importance in the estimation of those who have the care of the public health; but I must defer their consideration for the present.

CLEANLINESS AND ORDER IN THE SHOP.

Mr. J. E. Wilson, in writing an article for the *American Machinist* upon this subject, says a great many things which are as applicable in the tin shop as in the machine shop. If the one needs system so does the other, and certainly both should be equally neat:

We nowhere see more fitly exemplified the truth of the proverbs, "Cleanliness is next to godliness," and "Order is heaven's first law," than in the management of the modern machine shop.

Cleanliness and order are most important fundamental factors in the economy of the workshop, for without one the other cannot exist.

Cleanliness begets system, and without system the full measure of success, either mechanical or financial, or even spiritual, will not be realized. This may be stating it "strong," but the position can be sustained.

If the mechanic will consider that more of his time is passed in the shop than in social intercourse with his family or friends, he will see how inconsistent he is to allow any less degree of cleanliness and order to reign in his shop that he would countenance in his own household.

But it is of its utility, as an element in the successful management and conduct of the machine shop, that I wish to speak. A few years ago, while visiting a shop where about 30 men were employed, the question was asked of the foreman—who was up to his eyes in gudgeon grease—"Why don't you pick up your tools, and clean up the shop and machines a little?" His answer was: "O, we haven't got no time to clean up. Our business is to make machinery; besides, we do clean up every Saturday night." A year later, having occasion to visit the same shop again, the old landmarks had disappeared; a transformation had been wrought; over 100 men were now employed; the shop and machinery were clean and bright; the atmosphere had changed, and was as pleasant and congenial as a parlor, notwithstanding the usual noise.

We inquired for the foreman, and he came forward from among the men. But, as he came, he called the attention of a boy to a turning tool which had fallen under his lathe, and that movement disclosed the secret of the whole thing. It is needless to say that he was a new foreman, whose strong point was order, and the whole tone of the shop and character and quality of the work bespoke it.

"Now, of what practical utility was this change, allowing that there was no difference in the mechanical ability of the two foremen?" may possibly be the question of some one who is conscious of deficiency in this regard. In the first place, clean machines are always in order; consequently, better work can be done on them, and they run with less friction—an item in the coal and oil bill. Tools are in their places; there is no loss of time hunting them up; hence, economy is insured in the cost of labor on a given job, for no job should be charged with the cost of hunting for tools which were used on a previous one.

Besides, there are many other advantages to the men themselves, such as less wear and tear on clothing (which works itself out at the washtub), increase of self-respect, stimulating ambition, &c., all tending upward, demonstrating the truth of the godliness of cleanliness and putting more dollars into the pockets of all concerned. It is all the more profitable because it costs nothing. Modern machinery is so largely automatic that there is an abundance of time, while cuts are making, to wipe off surfaces not in proximity to running parts. The bench workman will do more work, if his bench is clean, than if he had to handle over a dozen tools before finding the one wanted. Racks and shelves are a thousand times better than chests or drawers for holding bench tools, and no more labor or time is involved in putting up a tool at once after use than at any other time.

The apprentice should be taught that cleanliness and order are the first necessary adjuncts to mechanical superiority and success, and that without them his services will depreciate in value, no matter how good a workman he may become.

It may seem late in the day to press points which are so largely recognized and self-evident; but a little observation will reveal a strange disregard of them among those shops considered first class. Their offices will be found fitted with elegant furniture and every convenience; artistic letter and bill heads and everything betokening fine taste, culture and perfect adaptation of means to ends. Not a speck of dust is visible or even a penholder out of place. The system of accounts is the best the schools and experience can afford; order reigns supreme, and there could be nothing more desirable. But enter the machine room! Are the same principles there in force? I venture to say—and it is from somewhat extended observation—that this is the weak point with 90 per cent. of them. The exceptions are greater lights among the lesser, and may be known by the character of their work, their workmen and the size of their dividends.

If the schools, about which the veteran mechanics know but little, would place the importance of these things before their students, they might accomplish nearly as much for the advancement of the arts as by their mechanical training.

EDUCATION BY THE EYE.

The great value of object-lessons is nowadays fully recognized by the teachers in our elementary schools, and professors of science, not to speak of popular lecturers, know the almost absolute necessity of appealing to the eye, as well as to the ear, if they desire to impress the subjects of their lectures on the memories of the students forming their classes. The mind may be stored with a knowledge of facts and phenomena by a judicious course of reading; but, unless some special effort is made to impress them upon the memory, they are recalled with difficulty, and sometimes escape altogether, just when they are most needed. A student may have read through a whole volume of physics so many times that he is perfectly familiar with any subject introduced by a lecturer, and yet be unable to give a clear account of the phenomena after he has left the lecture-room. He has been educated by the eye, in a certain sense, but not in the sense we mean. Lectures without experiments are simply words that pass in at one ear and out at the other; but, if the facts are demonstrated by means of experiments, another faculty is called into play, and the student is enabled to produce a mental picture of the phenomena, quite apart, it would seem, from that faculty which we ordinarily understand by the term "memory." A student with a good memory, as it is called, never fails to pass the South Kensington Science Examinations, because his mind, having been stored with facts and figures which will enable him to answer the questions, he has practically no difficulty in writing out the reply required; but, take this student into some practical branch of science, set him to observe the reactions in even a simple chemical process, or to give an account of the discoveries of a geological field-day, and in nine cases out of ten, he will fail deplorably. His mind has been instructed and disciplined by a course of reading, but, save the few experiments he may have witnessed in lectures, the faculty of eye-memory has been left practically uncultivated. An accomplished musician will sit down and play from memory a long and intricate *opus* without a fault, although, away from the instrument he would be unable to dictate to another what notes he should write. With paper before him, and pen in hand, he would in all probability, write out the piece without an error, because, then the faculty of high memory would be exerted with almost as much intensity as when sitting in front of the keys of the instrument. Just as it is possible by an effort to remember things we have heard or seen, to get them as we say, by heart, so it is possible to get them by sight, and it cannot be doubted that the one branch of education is as useful as the other. In a recent lecture delivered by Mr. C. G. Leland, before the Franklin Institute, he gave many instances of the power of a cultivated eye-memory, and though some may be open to doubt—scientific doubt—those which occurred in his personal experience may certainly be accepted as facts. Several writers have recognized and described the faculty of recalling visions at will, the power to produce objective pseudopia; but so far as Mr. Leland's researches have extended not one has ever contemplated the deliberate cultivation of volitional vision as an aid to every branch of intellectual education and art. He believes that entire books can be thus memorised, that all which the eye has seen the trained will can revive, and that beyond this, imagination, aided by volition, will evoke from the brain all manner of beautiful forms, and create from them others more beautiful.

In the School of Design at St. Petersburg, great attention is paid to freehand drawing, and the method pursued is to place an object before the pupils for ten minutes, telling them to study it thoroughly. It is then removed and the pupils set to work to draw it. Not a few of the most celebrated teachers of drawing and painting have adopted this method in a mollified form; they placed the image or picture to be copied in an adjoining room, and allowed their pupils to take an occasional look at it. The duration of the observation was not limited; but, by thus compelling the pupils to carry the object in their "mind's eye," a more careful study was made than if the object had been continuously before them. Mr. Leland tells us he has met a coach-maker and draughtsman who had so trained his eye, that he could draw and colour any vehicle, even to the detail of the minutest ornaments, after once seeing it pass by. He is also acquainted with a lady who, whilst in Europe, "memorised" many galleries of pictures and shop-windows, and it is related of Nicolas Loir, an eminent French painter and engraver, that, whilst in Italy he developed the faculty of eye-memory to such an extent that he was afterwards able to sketch with fidelity all the pictures that had pleased him most. It is well known that in this country, for instance, there are hundreds of accountants who are enabled to work out quite lengthy sums entirely by visual representations, and we need only mention chess to recall many feats of memory which, in all probability, depended on a highly-developed power of producing objective pseudopia. De Quincy says that young people possess the power of memory by sight more than those advanced in years, which may probably be due to the fact that we more readily acquire information when young, and the mind is comparatively fresh, than when the brain has been stored with a heterogeneous collection of memories. Houdin, the great conjurer, knew the value of eye-memory, and cultivated it to an extraordinary extent. He and his son Emile practised with dominoes so persistently, that, at last, they could give instantaneously the number of points on a dozen. Another task they undertook was to pass rapidly before a shop, and then taxed their memories by jotting down the number of objects seen in passing. The son excelled the father in this exercise, for he would often recall 40 objects to Houdin's 30; but mere enumeration of objects was not the limit of their task. for they practised so assiduously that at length they could not merely recall the principal objects in a shop-window, but could give a general description of them. This power formed the basis of the Second-Sight trick, which, as performed by Houdin, depended upon the accurate remembrance of the appearance of objects. By a few months' practice Houdin and his son acquired a power of vividly remembering anything they determined to remember, and cultivated their eye-memory to such a degree that they could describe objects with almost as much accuracy as if they were before them. This faculty of eye-memory is easily developed in school children, by taking the ordinay object-teaching a few steps higher. An object such as a statue, for instance, can be so indelibly photographed upon the memory that any scholar who can use a pencil in freehand drawing will reproduce it over and over again with almost absolute fidelity. The drawing of maps is a favorite task alike with school-masters, examining officers, and pupils, but with just a slight change in the *modus operandi*, it would not be difficult to so fix the map in the picture-gallery of the mind that it would never be forgotten. Mr. Leland asserts, and with good reason, that "the cultivation of eye-memory must be admitted by the greatest enemy to all new ideas in educatiou to combine all the discipline of intense study with all that is useful in object-teaching. It is the very opposite to anything like loose thinking or vagueness." One of its chief advantages, however, is the fact that while it calls for the closest observation and the greatest exercise of the memory must be followed with intense application and much practice, it is not disagreeable in the sense that many of the "lessons" of the schoolboy are disagreeable. As soon as the pupil begins to weary, the memory fails and it is useless to proceed with the work; but this rarely happens, for there is, of course, a limit to the time that should be devoted to the subject, whereas the first success in the practice of visual memory is so encouraging that even strenuous efforts to progress become a positive pleasure. Mr. Leland gives many instances among both dead and living persons in whom the faculty of eye-memory was largely developed, and he declares that children possess it universally, although in an undeveloped condition, while women possess it naturally in a higher degree than men. Thus he tells us that a lady will take in at a glance all the details of the dress and the head-gear of another to whom her attention may be specially drawn, and Mr. Francis Galton has also borne testimony to this fact. "The mental differance between the two sexes," he says, "seems wider in the vividness of their mental imagery, and the power of introspecting it, than in respect to any other combination of mental faculties of which I can think." As to the acquirement of eye-memory, Mr. Leland points out that as it can be exercised at any time without preparation, it is learnt without any apparent effort. He advises the student in commencing to stick to one subject until he can recall every detail of its shape and colour; and he points out that the development of quick observation in a merely mechanical manner, leads invariably to mental and intellectual quickness of perception, a fact which he declares, except so far as it has been recognized by object-lessons, has been entirely ignored in education, except by thieves and gypsies. Mr. Leland is collecting authentic instances of eye-memory, and will feel obliged to anyone who will send an account to him, addressed to the care of the Secretary of the Franklin Institute, Philadelphia.

TO CUT SHEET BRASS.—Moderately thick plates may be cut chemically by drawing a line or mark with a solution of mercury in nitric acid. The acid attacks the copper, while mercury amalgamates with the zinc; this seems to be the explanation; at any rate, the brass becomes as brittle as glass on the place where the line is drawn, and is easily broken off.

THE EMPLOYERS' LIABILITY ACT OF THE UNITED STATES.

By the provisions of this act, the workman, or, in case the injury results in death, the legal personal representatives of the workman, and any person entitled in case of death, shall have the same right of compensation and remedies against the employer as if the workman had not been a workman of the employer, nor in his service, nor engaged in his work. The right of compensation and remedies against the employer may be exercised where personal injury is caused to a workman—(1) by reason of any defect in the condition of the ways, works, machinery, or plant connected with or used in the business of the employer; or (2) by reason of the negligence of any person in the service of the employer, who has superintendence entrusted to him while in the exercise of such superintendence; or (3) by reason of the negligence of any person in the service of the employer, to whose orders or directions the workman at the time of the injury was bound to conform, and did conform, where such injury resulted from his having so conformed; or (4) by reason of the act or omission of any person in the service of the employer, done or made in obedience to the rules or by-laws of the employer, or in obedience to particular instructions given by any person delegated with the authority of the employer in that behalf; or (5) by reason of the negligence of any person in the service of the employer, who has the charge or control of any signal, points, locomotive, engine, or train upon a railway.

A workman shall not be entitled to any right of compensation or remedy against the employer unless the defect mentioned in (1) arose from or had not been discovered or remedied owing to the negligence of the employer, or of some person in the service of the employer, entrusted by him with the duty of seeing that the ways, works, etc., were in proper condition; or unless the injury resulted from some impropriety or defect in the rules, etc., mentioned in (4), provided that where a rule or by-law has been approved or has been accepted as a proper rule or by-law by one of her majesty's principal secretaries of state or by the Board of Trade, or any other department of the government, under any act of Parliament, it shall not be deemed to be an improper or defective rule or by-law; or unless, in case the workman knew of the defect or negligence which caused his injury, he should, within a reasonable time give, or cause to be given, information to the employer or some person superior to himself in the service of the employer, unless the workman was aware that the employer or superior already knew of the defect or negligence.

The amount recoverable shall not exceed a sum equivalent to the estimated earning the three years preceding the injury, of a person in the same grade employed during those years in the like employment in the district in which the workman is employed at the time of the injury.

Action for compensation shall not be maintainable unless notice of injury is given within six weeks, and action commenced within six months from the occurrence of the accident, or, in case of death, within twelve months from the time of death; but the want or notice shall be no bar to the maintenance of action, if the judge be of opinion that there was reasonable excuse.

From any compensation awarded under this act, there shall be deducted any penalty which may have been paid in pursuance of any other act of Parliament to such workman; and where an action has been brought under this act by any workman for compensation, and payment has not been previously made of any penalty under any other act of Parliament, in respect of the same cause of action, such workman shall not be entitled to receive any penalty under any other act of Parliament.

Action for recovery of compensation is to be brought in a county court; and upon trial in a county court before the judge without a jury, one or more assessors may be appointed to ascertain the amount of compensation.

Notice of injury shall give the name and address of the person injured, and shall state in ordinary language the cause of the injury, and the date at which it was sustained, and shall be served on the employer at his residence or his place of business; or by post by a registered letter; where the employer is a body of persons corporate or incorporate, the notice may be served by delivery or by post in a registered letter addressed to the office or offices of such body. A notice shall not be deemed invalid by reason of any defect or inaccuracy, unless the judge is of the opinion that the defendant is prejudiced in his defence thereby, and that the defect was for the purpose of misleading.

"Persons who has superintendence intrusted to him" means a person whose sole or principal duty is that of superintendence, or who is not ordinarily engaged in manual labor. "Employer" includes a body of persons corporate or incorporate. "Workman" means a railway servant, and any person to whom the Employers and Workmen Act, 1875, applies.

The act is not to come into operation until January 1st, 1881.

The act may be cited as the Employers' Liability Act, 1880, and shall continue in force until December 31st, 1887.

[An act somewhat similar to this should be passed for Canada.—Ed. S. C.]

Classifying Minerals.—The apparatus invented by Mr. W. Nance, of North Shields, consists of a series of pans of different diameters, and of any shape, or size, or kind of material, placed in a vertical or diagonal position, and is especially intended to separate minerals and metals from their gangue, and at the same time in the same operation to classify any number of metals or minerals of different specific gravity, which may be associated therewith. For instance, if two or more metals or minerals of different specific gravity be operated on in this apparatus, they will be separated from their gangue, and deposited in receptacles especially provided for the reception of each kind. The operation consists of a series of hydraulic currents in the said pans, to which the ores are submitted, and the said currents therein can be regulated to suit every difference of specific gravity, whereby an indefinite number of different specific gravities is obtained in one operation without manual labor, mechanical motions, or power other than a slight fall of water to produce the currents. By the use of this apparatus and method of treating ores, considerably less space is required for the mechanism and modes of operation, and a greater quantity of ore is treated in a given time than by the mechanism at present in use.—*London Mining Journal.*

Newfoundland.—A correspondent of the London *Times*, writing from Halifax, says: One matter of imperial interest is apparently about to be settled in a way by which the enterprising citizens of the United States will profit. Though the resident merchants care little for mines, the mines of Newfoundland are becoming very valuable. Mr. Ellershausen, from Nova Scotia, has recently developed some copper mines, and he has, in the brief space of five years, raised Newfoundland to the rank of the sixth copper-producing country in the world. I was informed that he had disposed of his properties for a very large sum to capitalists from the United States. Lead mines have also been discovered and worked; it has been proved that there is a mine of nickel in the island. There is good reason for believing that gold and coal will yet be found here in abundance. A moderate amount of capital judiciously invested in developing the resources of the island could hardly be better employed. The exports at present are chiefly confined to fish and minerals.

Thin Rolled Iron for Scientific Purposes.—In experiments made at the Alleghany observatory by Prof. Langley, on the measurement of radiant heat, he made use of a thermo-electric apparatus, a product of the American iron industry. Observations made with such instruments have shown that iron in extreme thinness is the most suitable material to be used with them, and in order to supply the demand, the Pittsburg mills have succeeded in manufacturing rolled iron which is so thin that from 10,000 to 12,000 sheets laid on each other equal only one inch in thickness. An instrument made out of this material has almost the same responsiveness to radiant heat which the eye has towards light.

How Flowers are Rendered Luminous.—We have already called attention to the preparation of luminous flowers which glow in the dark, and which are the latest elegant novelty offered for sale on the Paris boulevards. They are reported to have been rendered phosphorescent by coating first with a transparent size, and then dusting them with the phosphorescent salts of calcium or barium.

Scissors, the parts of which are still made in Sheffield, Eng., by a tedious hand process, are made at one stroke of a die in Connecticut. Hence, Sheffield sends to Connecticut for large quantities of steel blanks, which are forwarded in that form to Sheffield to be finished, and then returned to supply American customers, who will not be satisfied with anything but English-made scissors.

To Remove the Odor from Benzine.—Mr. R. F. Fairthorne suggests, in the *American Journal of Pharmacy*, that if three ounces of powdered quicklime be added to a gallon of benzine, and the mixture be well shaken, most of the peculiar sulphureted odor of the benzine will be removed; and articles that have been washed in it will have no disagreeable smell.

CUSHING'S SAFETY HYDRO-PNEUMATIC ELEVATOR.

(*From the Manufacturer and Builder.*)

We illustrate and describe in what follows, a system of hoisting machinery known as the Johnson & Bailey system, which appears to combine to an eminent degree the qualities of safety with speed and economy. The system in question, as will be observed further on, is hydro-pneumatic—in other words, compressed air and water are used, the former being employed to do the lifting, while the water is relied upon to give steadiness to the movement of the car in ascending or descending. As elevator accidents are still by no means as rare as they should be, in spite of the amount of inventive talent that has been of late years devoted to the perfection of this class of machinery, our readers will be interested in perusing the following description of an apparatus which embodies some really valuable improvements :

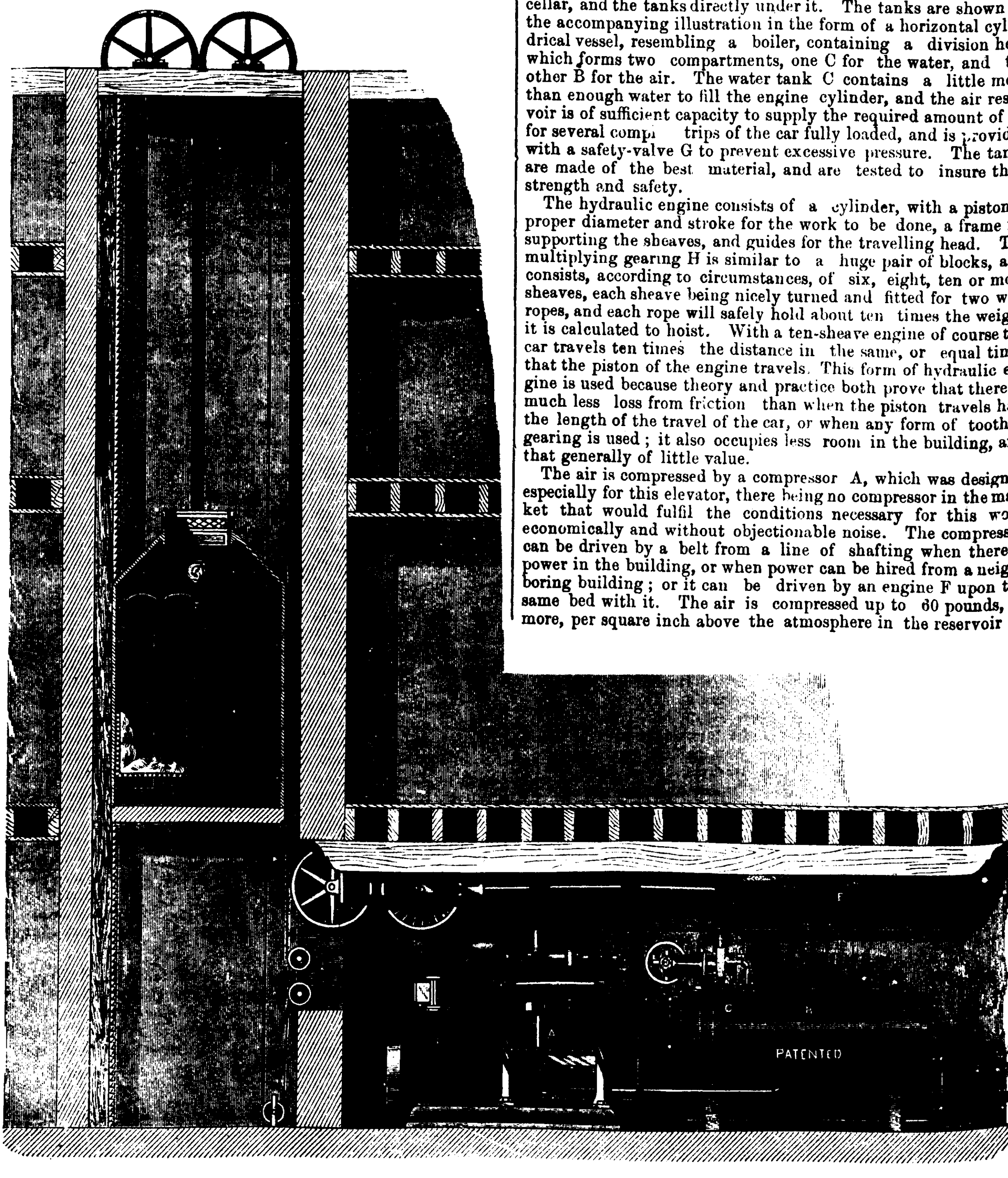


FIG. 1.—NEW SAFETY HYDRO-PNEUMATIC ELEVATOR.

The ordinary hydraulic elevators are provided with a tank of some size, which is located at the top of the building, and another in the cellar, the water being pumped from the cellar to the upper tank, and flowing thence to the hydraulic engine, the height of the water column so obtained giving the pressure used to lift the car and its load. No provision is made in this type of apparatus to regulate the pressure according to the load to be lifted, as the height of the column and its pressure remains uniform, whether the load be heavy or light; consequently, as much work is expended in the one case where it is necessary as in another where it is not.

In the Johnson & Bailey system, all the advantages of the hydraulic system are retained, and this defect is simply and effectively remedied. The tanks are located near to the hydraulic engine in the cellar of the building. The hydraulic engine E, Fig. 1, usually bolted to the underside of the floor above the cellar, and the tanks directly under it. The tanks are shown in the accompanying illustration in the form of a horizontal cylindrical vessel, resembling a boiler, containing a division head which forms two compartments, one C for the water, and the other B for the air. The water tank C contains a little more than enough water to fill the engine cylinder, and the air reservoir is of sufficient capacity to supply the required amount of air for several compl trips of the car fully loaded, and is provided with a safety-valve G to prevent excessive pressure. The tanks are made of the best material, and are tested to insure their strength and safety.

The hydraulic engine consists of a cylinder, with a piston of proper diameter and stroke for the work to be done, a frame for supporting the sheaves, and guides for the travelling head. The multiplying gearing H is similar to a huge pair of blocks, and consists, according to circumstances, of six, eight, ten or more sheaves, each sheave being nicely turned and fitted for two wire ropes, and each rope will safely hold about ten times the weight it is calculated to hoist. With a ten-sheave engine of course the car travels ten times the distance in the same, or equal time, that the piston of the engine travels. This form of hydraulic engine is used because theory and practice both prove that there is much less loss from friction than when the piston travels half the length of the travel of the car, or when any form of toothed gearing is used; it also occupies less room in the building, and that generally of little value.

The air is compressed by a compressor A, which was designed especially for this elevator, there being no compressor in the market that would fulfil the conditions necessary for this work economically and without objectionable noise. The compressor can be driven by a belt from a line of shafting when there is power in the building, or when power can be hired from a neighboring building; or it can be driven by an engine F upon the same bed with it. The air is compressed up to 60 pounds, or more, per square inch above the atmosphere in the reservoir B.

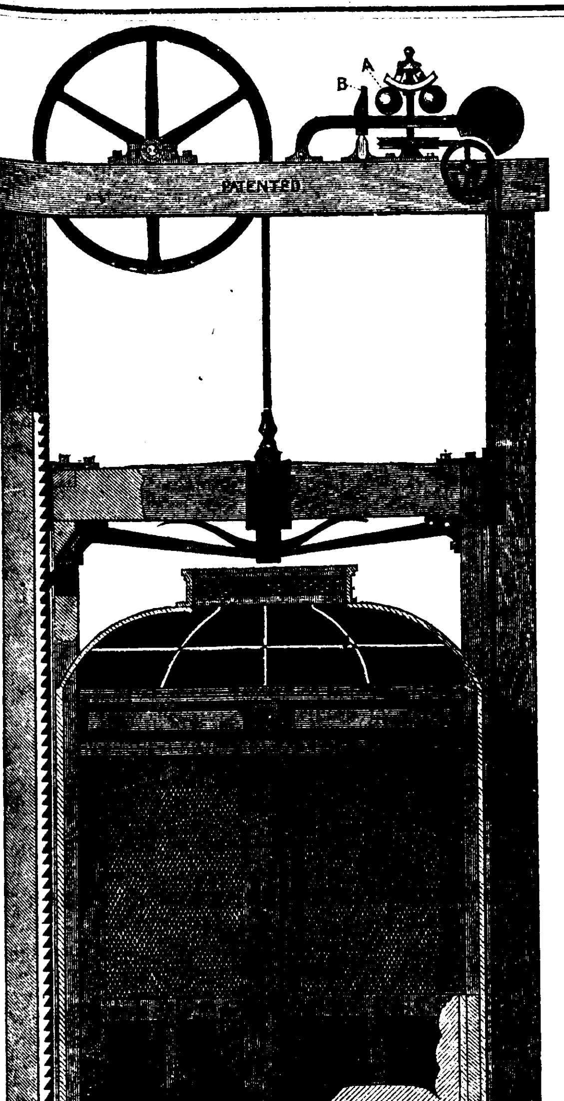


Fig. 2.—Safety device for Elevator Car.

From the reservoir, as it is wanted, the air passes to the top of the water tank C; the pressure of the air upon the surface of the water in the tank forces the water out of the tank, through the pipes and valves D, into the engine cylinder E and against the piston; when the pressure against the piston exceeds the amount necessary to overcome the friction of the machinery and the weight of the load in the car, the piston moves and the car is raised. Between the air reservoir B, and the water tank C, there is an automatic regulating valve, which has the pressure of the air in the reservoir upon the one side of it, and the pressure upon the piston, due to the load in the car, upon the other side of it; the difference in these pressures opens the valve enough to allow a sufficient amount of air to pass to the water tank to overcome the resistance offered by the load in the car, and no more; by this means a light pressure is supplied for a light load and a heavy pressure for a heavy load; the action is automatic, and the result very economical.

Another economical feature is this: When the operator in the car pulls the cord to descend, the air supply valve is shut, the water valve opened, and the exhaust valve opened; the air which has just been used to lift the load is exhausted from the top of the water tank C into a pipe that leads directly to the suction of the air compressor A, and also to the back end of the engine cylinder E. As soon as the pressure upon the front and back side of the engine piston is equalized, which is almost instantly, the weight of the load in the car causes it to descend as fast as the water is permitted to be transferred from the engine cylinder through the main or water valve into the water tank, and the speed is entirely under the control of the operator in the car, who can open or close the valve, more or less, at will. At the same time, while the car is coming down, the compressor A is pumping the air, which has just been exhausted, back into the air reservoir B again, and, instead of pumping free air of 14.7 pounds absolute or atmospheric pressure, the air is returned to the compressor at a pressure which will depend upon the weight of the load just hoisted, and may be 40 or 60 pounds absolute pressure in the beginning, which will gradually be reduced by the pumping of the compressor until it falls enough below the atmospheric pressure to allow the suction check valve to open, and free air is taken in. By this arrangement, the same air is used over and over again, the slight leakages, if any, being made up by the compressor from free air, when necessary; the theoretical losses due to air compression are reduced to the lowest practical limits, and a smaller air compressor can be used than would be necessary to pump the required quantity of free air.

The guide posts for the car extend throughout the whole height of the building, from the cellar to the roof, and are faced with safety ratchets, between which the safety car platform is raised and lowered by means of the two wire lifting ropes which are connected with the hydraulic engine. The car platform is moved at any speed desired by the operator, and when stopped, is held rigidly in place by the water between the piston and the valve. The valves are balanced and tight. The car platform (Fig. 1) is fitted with safety locking pawls, combined with a powerful steel spring, and the simplest possible device for forcing the safety pawls into contact with the safety ratchets should the lifting ropes break. These have been used for many years, have proved perfectly reliable, and can be depended upon to reduce the fall possible to the car to the length of the ratchet tooth.

Besides the ordinary safety pawls attached to the lifting ropes, there is an extra set of patent safety pawls E underneath the platform of the car, which are operated by a separate wire safety rope; this rope is a safety device entirely disconnected from any of the other working parts of the apparatus, and extends from the top to the bottom of the hoistway, running over pulleys at the top and bottom, and both ends are connected to the lever D (see Fig. 2), which operates the safety pawls under the car. The safety rope travels with and at the same speed as the car. In the upper part of the hoistway the rope passes over pulleys which give motion to a safety hammer or brake A. When the car is running at its ordinary speed, the safety hammer does not act; but as soon as the speed is accelerated beyond what it should be, the balls A fly out and strike the catch-plate B, the brake is dropped, and the motion of the safety rope ceases, while the motion of the car is continued far enough to throw the safety pawls or dogs E into the safety ratchets, and the car stops instantly. In addition to the above-mentioned safety devices, there is also an automatic stop upon the hydraulic engine, so that if the check rope should break, and the operator lose control of the car, the engine will stop itself when the car arrives at the top or bottom of its run.

The manufacturer claims for this apparatus, that every kind of accident that has been known to occur during many years of experience, or that can be imagined, has been provided for and guarded against, and that there are no better or simpler safety devices in use to-day than are supplied with these elevators. It is further claimed that the apparatus has certain special advantages over others, the most important of which are that the amount of pressure needed to raise a given load is automatically regulated, thus insuring the greatest possible economy in doing its work; that any amount of pressure, within reasonable limits, can be obtained in an emergency to raise special loads; that the movement of the car is free from jerks and oscillations; that it obviates the necessity of heavy tanks of water to be supported on the roof of the building, and of pipes running through the building to freeze and leak, and cause trouble in other ways; that the mechanism is simple and strong, not liable to get out of order; that it is economical in running; and finally, that it can be run faster with perfect safety than any other form of elevator.

These elevators are made by N. B. Cushing, foot of Morris street, Jersey City, N. J.

CHIMNEY BUILDING.

Why people will presist in building chimneys which will not draw, remains to us a mystery. No part of a house contributes in a greater degree to the comfort, and even the health, of the occupants than a chimney with a good draft, and yet, year after year, people go on putting up little 7 x 9 flues in the walls of their houses if they are in the city, or little 7 x 9 brick boxes in the country, and persist in calling them chimneys, To make an open fire-place draw without smoking where there is such a flue, is simply impossible. With such flues a "roaring fire" is never heard. At the Underwriter's Convention, held in Chicago, Mr. Daniel Morse, of the Home Insurance Company of New York, read the following paper on how a chimney should be built.

1. A broad, deep and substantial foundation is necessary—one that will not settle or be disturbed by frost. If the chimney is built in or rests upon the wall of the basement or cellar, the wall at that point should be sufficiently broad.

2. The chimney should be perpendicular, straight and smooth, without angles, corners, jogs or contraction, and at no point in contact with wood; with a space of an inch or more where it passes joists, rafters or timbers, or through floors, ceilings or roofs, and at least 4 inches between the back of the chimney and the end or side of the building. Joists should not be masoned in or rest upon or against the chimney wall, but a header well removed from the chimney should be used for their support. An additional reason why chimneys should be built very strong and entirely free from contact with any wood in the frame buildings of our Western country, is that they are so often what is known as "balloon frames," so lightly put up that they are always liable to be shaken by our heavy winds, so as to cause cracks in chimneys otherwise constructed.

3. The walls of the chimneys, when built of brick, should be 6, 8 or more inches thick. A chimney with 6-inch walls, the inside course set on the edge and bound with brick laid transversely every four or five courses, is nearly as safe as an 8-inch. Where an 8-inch wall is laid, it is perhaps better to leave a space of about an inch between the two courses of brick, occasionally binding by laying a brick transversely. A wall of this kind will not heat so as to endanger wood, even in pretty close proximity. The chimney should be put up at a time when free access can be had by the masons to every part of its outside, before joists and other timbers have been placed in the way, and before the roof has been put on. Four-inch walls are unsafe at the best, and particularly so if there is any truth in the theory that brick, exposed to hot air or steam, will in time show a larger amount of heat than is at any time in the heated air or steam passing by or in contact with it; that is, if brick will accumulate heat, as we know some metals and minerals do. We know of some facts that seems to support this theory. If it is true, many queer fires from furnaces and chimneys will perhaps be more satisfactorily accounted for.

4. There should be openings at the bottom of the chimney, and of each separate flue, for the removal of soot. These openings should be closed with a heavy iron box or scoop-shaped stopper. If left open the draft will be affected, and, besides, there will be danger of fire falling upon the floor. These soot boxes, or scoops, unless made of heavy iron, are liable to rust out, owing to the damp soot and pyroligneous acid.

5. The chimney should be smoothly plastered with a mortar composed of one part fresh cow dung and three parts ordinary mortar. The mixture should be made from time to time, as needed, and applied before it has time to set and become hard. A chimney so plastered will present a hard surface, nearly as smooth as glass. Soot will not accumulate on the sides of the flue, and the draft will be quite perfect, other things being observed. The draft will be still further improved if the area of the flue is increased 1 inch every 10 feet from the bottom to the top.

6. The flue for an ordinary dwelling fire-place or stove-pipe, should have an area of at least 128 square inches for a wood or soft coal-fire and not less than 96 square inches for a grate or stove burning hard coal. Where large wood or soft coal fires are required, the area should be 192 square inches. Each fire-place or stove-pipe should have a separate flue, otherwise you cannot rely upon the draft. If for any cause more than one stove-pipe is to enter the same flue, the size of the flue should be increased one-fourth for each additional pipe.

7. The hearth should rest upon a brick or stone arch. Timber and board foundations are always concealed incendiaries; iron, because of its power to conduct heat, is also unsafe.

8. The throat of the fire-place should be well contracted and pitched forward, so as to be directly over the fire. This will insure a draft, owing to the fact that the part of the atmosphere not passing through the fire, but entering the flue, will come in more direct contact with the heat, and thereby be more highly rarefied. The construction of the chimney being right, the draft is produced by the air being rarefied in passing through and over the fire. This heated and lighter air ascends the flue, while the denser air in the room rushes forward to supply the partial vacuum. Sametimes the draft is imperfect because a sufficient supply of air is not admitted to the room, and in other cases owing to an open pipe or soot-box hole. All openings should be closed with brick and mortar or closely fitted metal stoppers. The modern practice of pasting a piece of paper over an opening should not be permitted.

9. The walls of the chimney, particularly on the back side, where it is concealed from inspection, and at points where the chimney passes near wood, should be most carefully laid, pointed and plastered on the outside. Fires from defective flues where there is no crack, usually reveal the fact, if the chimney is left standing, that the wall on the back side, at points passing near timbers through floors on the roof, has not been well pointed and plastered on the outside. Good work has been done only at points or places exposed to the eye, and where there was no danger from fire.

10. The practice in many cases of building a water-shed by projecting the brick just above the roof, should not obtain, nor should the chimney at this point be enlarged for any purpose. The projecting bricks, in a majority of cases, rest upon the rafters or roof boards: and if at any time the chimney below should settle there will be a crack and by and by fire. Chimneys thus enlarged above the roof presenting a massive and substantial appearance, fail to suggest the truth as to the small and cheaply constructed flue below. A word in regard to chimney sweeps and state periods for cleaning flues. In places where ordinances have been passed and enforced on this subject, and sweeps licensed, fires caused by the burning out of chimneys or from defective flues, have been of rare occurrence. Perhaps, if in our respective fields we were to aid in having ordinances touching this matter passed, we would prove ourselves public benefactors, and at the same time promote the interests of insurance companies.

IMPROVED MORTAR AND ARTIFICIAL STONES.

M. Decourneau attributes the cracks in common mortars and cements to the uncombined quicklime that they contain. In order to neutralize the lime, he uses an *agrégat* composed of a very fine silicious powder, mixed with diluted nitric acid. He thus obtains mortar with much greater, more uniform and more lasting resistance than those hitherto used. The application of his method, especially in the new forts of Paris, has given excellent results, without a single failure. Stones made by his process may be sawed and chiselled like natural stone.

FIRE-RESISTING QUALITIES OF BUILDING STONE.—Doctor Cutting, State Geologist of Vermont, has concluded his unique series of tests on the fire-resisting qualities of building stones. He sums up the result in the current number of the *Weekly Underwriter*. He declares, in substance, that no known natural stone deserves the name fire-proof. Conglomerates and slates have "no capacity" of standing heat; granite is injured beyond cheap or easy repair by even so mild a heat as that which melts lead; sand stones, including the variety called brownstone in this city, are better, and limestones and marbles are perhaps the best in this respect. But even they are injured by continuous heat of 900°, and 1,200° are changed into quicklime. Therefore it would seem that no stone buildings are fire-proof, and some of them, Dr. Cutting even says, are as much damaged by fire as wooden structures are. Brick, on the contrary, is usually uninjured, and is often rather improved by heat until it is melted. But as most brick buildings are trimmed with iron or stone, the damage is often considerable, even when the walls stand. To avoid this, Dr. Cutting recommends soap-stone trimmings, which are open only to the objection of expense. But although brick stands heat so well, it is objectionable, because its power to resist pressure without crumbling from dampness or frost, is less than that of stone. Nevertheless, as brick is in fact only a kind of artificial stone, the search for an ideal building material is not hopeless, but it must be prosecuted rather by the maker than by the quarrier of stone.

ASBESTOS POWDER.—Asbestos powder, made into a thick paste with liquid silicate of soda, is used with great advantage for making joints, fitting taps, and connecting pipes, filling cracks, &c., It hardens very quickly, stands any heat, and is steam tight.

MODELLING IN CLAY.

Any one who could have seen the group of a dozen or fifteen children who last summer gave up a portion of their vacation play-time to gather regularly ronnd a long bench in an old barn not far from this city, as with busy intentness they followed the instructions of their teacher in the use of clay and modelling tools, would have had small doubt of the efficiency of Kindergarten teaching. And had such an observer turned from this sight to the little book berore us he would have had small need to question the truth of Mr. Vago's own statement "that one practical esson in an artist's studio is more useful to the learner than a dozen books full of theory."

With the Kindergarten system of object-teaching we have decided sympathy, particularly where an attempt is made to waken early in life in all the children submitted to its working, those faculties of head and hand to which the hard practicalities of after life or the unbeautiful surroundings and practices of individual homes might otherwise deny their possible development; for as our author says in his preface, "Although as a fact no kind of training will produce faculties, yet, on this account, we may not claim the excuse of being deficient, for, except in cases of idiocy, it is as unusual for a person to lack any one of the natural faculties as it is to see a face without a nose." How far the faculty for modelling in clay is natural and universal, and consequently in most individuals a wholly dormant and wasted power, we do not know; nor do we know to what degree its development would have an elevating and refining influence on those who cultivated it; but we do believe that the endeavor to develop it could hardly fail of producing an intellectual gain, even if the attempt were a failure,—although as much might be said of any mental effort.

To a large class of craftsmen and others, amongst whom are architectural students and draughtsmen, the power of modelling in clay the details of decoration which they now have to design with pencil and brush, might be of incalculable benefit, but we fear that they will not be able to retain much real instruction from the little work before us, interesting as it is in some ways. As a practical treatise on modelling it is incomplete in many ways, although as an amateur treatise on phrenology it is quite entertaining in spite of the author's sometimes confused and inappropriate choice of words, as for instance where, in speaking of modelling busts, he says: "The geography of the head, as furnished by the phrenological divisions, supplies land-marks whereby the ground can be reconnoitred with precision."

To such remarks as "A person need not be a Royal Academician to be able to make suggestions which may be of advantage to the artist," or this, "But this branch of the art (modelling bas-reliefs) in some cases conjoins that of the painter, wherein it is necessary to observe the rules of perspective," we entirely agree. Other remarks it would have been more judicious to have left out, as for instance where the writer confesses that he does not know "whether any rule is recognized among painters which may direct the pupil with regard to perspective other than that of watching his work at such a distance as it is intended to be viewed from by the spectators."

Instruction in taking casts from the completed model is almost as necessary as that for making the model itself, and it is disappointing to find only the method of "waste moulding,"—in which both model and mould are destroyed in making a single cast,—is described at length. That it is possible to make the mould in detachable pieces, so that from it may be secured an indeterminate number of casts, is barely hinted, while the very useful accomplishment of taking "squeezes," the use of wax and gelatine in making moulds for casts where the model is much undercut, and the large amount of practical information and instruction in modelling for commercial rather than for artistic purposes, are quite neglected.

On the whole it seems that Mr. Vago's portion of the book is more interesting as a discussion of some bearings of the art than instructive in it. Mr. Pitman's appendix—only ten pages long—might, almost without loss, have been condensed into some such single sentence as this: "Do not use for your first model the old boot Mr. Vago advises, but rather copy a large leaf."

Japanese Paper Air-Cushions.—Japanese paper air-cushions are said to have some advantages over those made of rubber. They may be rolled into a package of smaller dimensions when not in use; they will not stick together as rubber does after it is wet, and for pillows they are better because they have no odour. Their strength is marvellous; a man weighing 160 pounds may stand upon one without bursting it. They are said to be waterproof, and to make excellent life-preservers.

PAINTING ON GOLD PAPER.

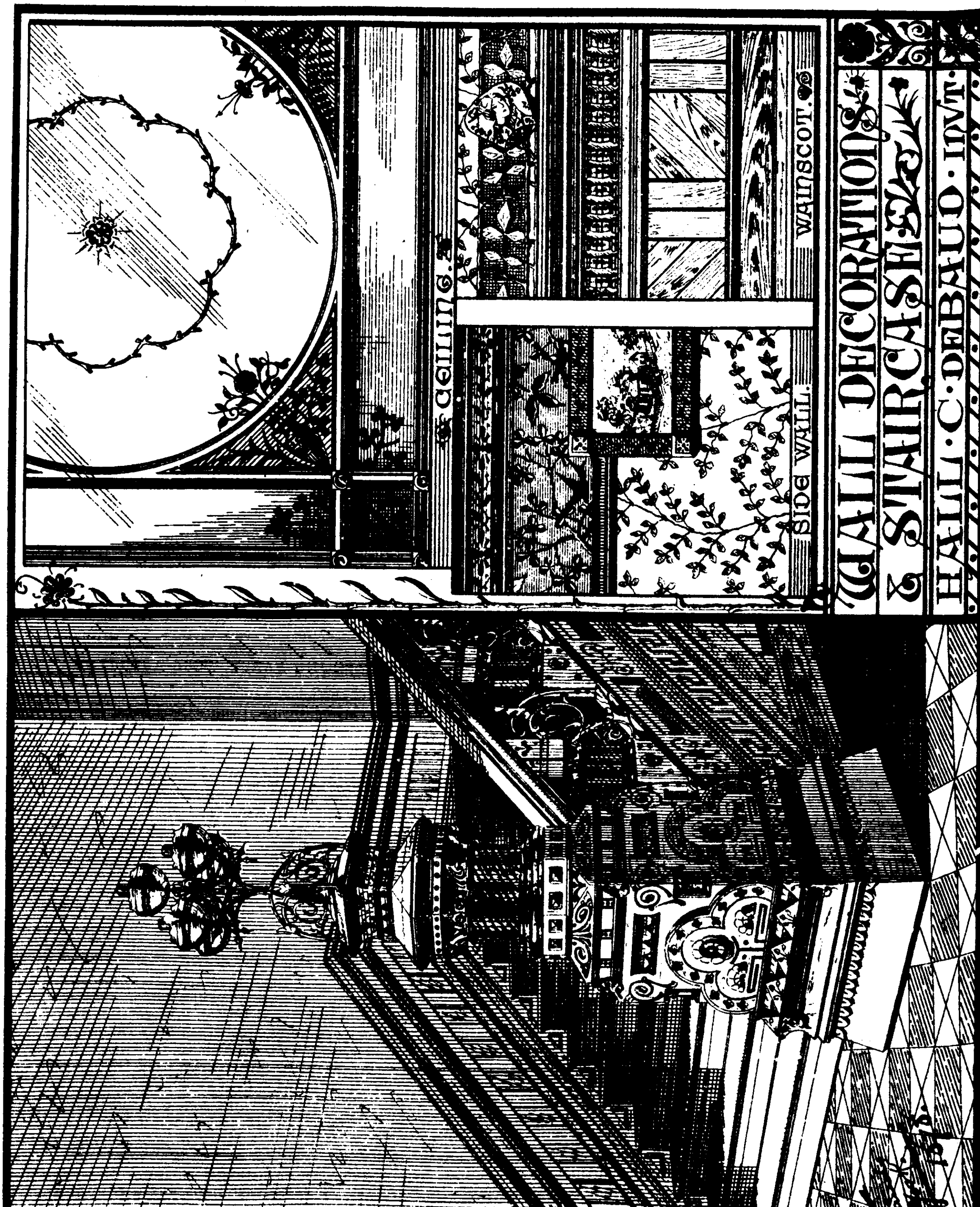
The necessary materials are: First, the paper itself, which is of two kinds—plain and craped, the latter to be preferred, as the craped surface does not show the joints of the gold leaf; next, Chinese white and ordinary water colors, used with red sable brushes; and finally, a piece of tissue paper or chamois leather for resting the head upon. The paper being cut to size, it is fastened to the drawing-board with pins, and used without any preparation. No rubbing out or alteration being possible as the gilding would thereby be removed, it is advisable, unless in the case of an expert, to draw the design determined on upon common paper, and then transfer it to gold in the ordinary way, filling it in with Chinese white ground to the consistency of cream, and in the case of large surfaces, where there is any danger of cracking, mixing the white with a minute quantity of water color megilp. But when it is possible, the far better plan is to lay it on at once with the Chinese white, without any outline at all, for it is work which does not stand being tossed about. In neither case must the brush be too full, nor must the white be so liquid as to run.

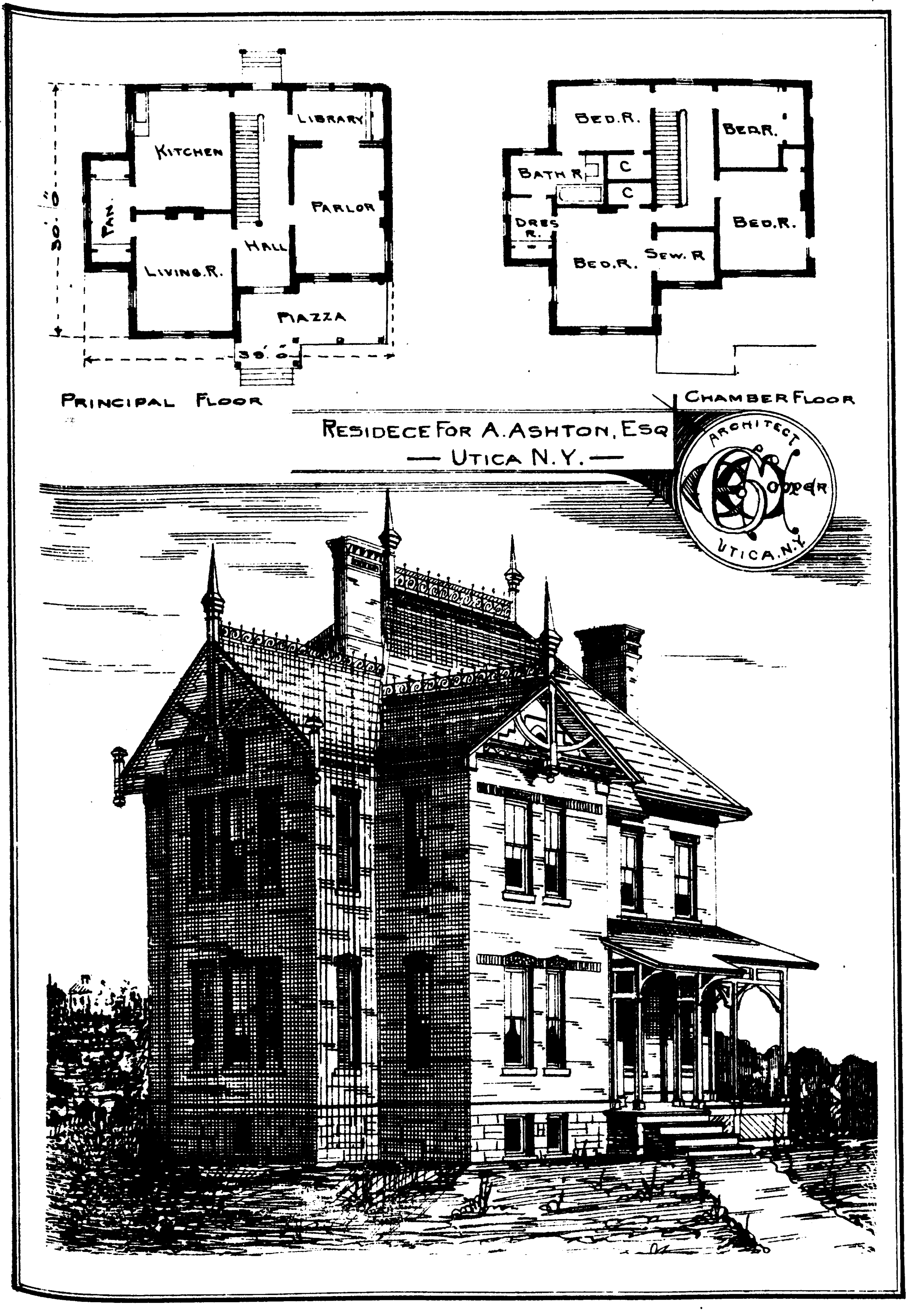
The white being perfectly dry, it is painted over with the proper colors and the work is finished. Supposing a naturalistic effect is desired, the light and shade, which must be very distinct, are put on in the ordinary way, and no outline should be visible; but the work may be intended to have a flat and mediæval treatment, and it then may be executed as an illumination, and a fine outline can be added with either lamp black or sepia.

It will be seen in the painting that only opaque color can be used, as without the foundation or "base" of Chinese white the gilding will show through; illuminating colors which are sold readily prepared with a body, can, however, be employed, and ordinary colors may be mixed in the first instance with the Chinese white and laid directly on the paper; but this process so materially changes their tint that it should be tried with all of them before they are used in permanent work. Many are dulled, and are all made lighter by it, and if they are mixed in this way the darker shades should be put in with pure and transparent color.

POLISHING FANCY WOOD ARTICLES.

To polish such articles as they are done in shops requires a knowledge of varnishing that must be learnt, like everything else. The process is tedious, but not difficult. The varnish should be of the best, and should be either a light oak varnish or a white varnish. If made at home, the varnish should be kept six months before it is used, and exposed to the light, but not to the sun; the bottle containing it should not be corked, but covered with thick muslin, so that air, but not dust, reaches the contents. Old varnish is more easily applied than new, and takes a better polish. White varnish is made of copal, 7½ oz.; camphor, 1 oz.; alcohol, 95 per cent., 1 quart, dissolved, to which is added mastic gum, 2 oz.; Venice turpentine, 1 oz. The whole mixture being dissolved, it is strained and put into bottles. Oak varnish is made of resin, 3½lb; and oil of turpentine, 1 gal. These are dissolved together and strained. Varnishing must always be done in a room a few degrees above summer heat, and the work should be placed in a current of air and carefully guarded against sun or damp. If kept too cold the varnish will turn white, if too hot it will blister. Warm the work and also the bottle of varnish by placing them near the fire, then dip a soft varnishing brush in the varnish, and, beginning in the middle, rapidly pass the brush over every part, taking care not to touch the same part twice. Leave till dry, then apply another coat; if the varnish is good it will dry sufficiently quick to allow of two coats a day. Six coats are the usual quantity laid on. Leave it a fortnight and then polish. The varnish is ready for polishing when its surface is covered with a network of cracks; these have to be carefully effaced. Make a rubber by doubling a piece of serge several times and sewing it up. Take some very finely powdered pumice stone; dip the end of the rubber into the water, and then into the pumice stone, and rub the whole surface of the work backwards and forwards and round and round adding more water and pumice as required. Until the polishing is complete the pressure of dry fingers upon the work would leave a mark, the hands must therefore be kept wet. Do not run too heavily, as the varnish will then rub up, but wipe the work constantly to see its condition. When all the cracks are removed wash the work and dry it. Take a small piece of mutton suet, and polish the varnish by rubbing it over it and drying with flour. Continue until the varnish is brilliant and finish by rubbing it with the palm of the hand.


CEILING.
WAINSCOT.
SIDE WALL.
HALL DECORATIONS
& STAIRCASE
HALL · C · DEBAUD · INVT.


KITCHEN
LIBRARY
PARLOR
PAN.
HALL
LIVING R.
PIAZZA
30' 0"
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PRINCIPAL FLOOR
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BATH R.
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SEW. R
CHAMBER FLOOR
RESIDECE FOR A. ASHTON, ESQ
— UTICA N.Y. —
ARCHITECT
Cooper
UTICA. N.Y.

PRACTICAL PAINTING.

CERTAIN PROPERTIES OF OIL PAINTS.

Painting is done with two objects in view—either to change the natural color of the surfaces of various articles, or to protect those articles by rendering their surfaces less easily altered by air, rain, dust, &c. Three conditions must be fulfilled:

1. The paint must possess sufficient fluidity to spread with a brush, and also be viscous enough to adhere to the surface without running, and to leave coats of equal thickness when the surfaces are inclined or even vertical.
2. The applied paint must become hard.
3. After hardening it must adhere firmly to the surface on which it has been applied.

To secure these conditions under all the conditions which must be met in the practical work of house painting, requires some knowledge of the chemistry of the materials used and the reactions induced by their exposure to light and air. M. Chevreul, the eminent French chemist, has lately given the subject much intelligent attention, and we are able to give our readers the following interesting synopsis of his conclusions, which will be found full of practical information and replete with good suggestions:

I have proved that the hardening of white lead or zinc-white paints is due to the absorption of the oxygen of the atmospheric air. And since pure oil hardens, we see that the hardening is the effect of a primary cause which is independent of the drier, white lead or zinc white. Besides, my experiments demonstrate that white lead and oxide of zinc manifest a drying property in many cases, and that this property exists also in certain substances which are painted—lead, for instance. The painter, therefore, who is desirous of knowing, at least approximately, the length of time necessary for his work to become dry, will have to consider all the causes which produce that effect. Consequently a *drier* will not be considered as the *only cause* of the drying phenomenon, since this phenomenon is assisted by several substances having also the property of drying under circumstances. Moreover, there is this remarkable fact, that the *resultante*, or sum of the activities (drying powers) of each of the substances entering into the composition of the paint, cannot be reckoned by the sum of the activities of each substance. Thus, pure linseed oil, the drying power of which is represented by 1,985, and oil treated by manganese, with an activity of 4,719, will, when mixed, possess an activity of 30,828. If there are substances which increase the drying properties of pure linseed oil, there are others which act in an opposite direction. For instance, if one coat of linseed oil is applied upon glass, it will dry after seventeen days; but if the same oil is mixed with oxide of antimony, it will take twenty-six days to dry. In this case the oxide of antimony acts as an anti-dryer. Linseed oil, mixed with oxide of antimony, and applied upon a cloth painted with white lead, will dry after 14 days; the same oil, mixed with the arseniate of protoxide of tin and applied upon the same cloth, will not harden for 60 days. Oak appears to possess an anti-drying property to a high degree, since, in an experiment made 22nd December, 1849, three coats of oil took 159 days to dry. In an experiment made 10th May, 1850, a first coat of linseed oil was dry only on the surface after 32 days. Poplar seems to be less anti-drying than oak, and Norway fir less than poplar. In the experiment of 10th May, 1850, three coats of linseed oil took 27 days to dry for poplar, and 23 days for Norway fir. If there be a drying activity and a contrary one in certain substances, I have no doubt that there are also circumstances under which linseed oil is not influenced by the nature of the surface on which it has been spread. For instance, in the experiments of 10th May, 1850, one coat of linseed oil was given upon surfaces of copper, brass, zinc, iron, porcelain and glass, and in every case the oil was dry after 48 hours. I hasten to say that I do not pretend to classify all the substances, when in contact with linseed oil, or any other drying, anti-drying, and neutral, because the circumstances under which these substances are placed may cause variations in their properties. I believe that a substance may be drying or anti-drying under different circumstances—whether it be due to the temperature, or the presence or absence of another substance, &c. For instance, metallic lead is drying towards pure linseed oil, whereas white lead, which is well known to possess drying properties, is anti-drying toward linseed oil applied upon metallic leaf. If painters desire to understand their operations well, they must consider the drying of their painting in the same manner as I have just pointed out. By so doing, and in certain determined cases differing one from the other, they will be enabled to modify and improve their ordinary methods. Linseed oil is naturally drying, and this property increases almost always by its admixture with white lead, and in certain cases with oxide of zinc. If the mixture be not sufficiently drying, resource is to be had to an addition of oil boiled with litharge or manganese. At the same time it is necessary to consider the nature of the surfaces painted over—whether it be a first, second or third coat, the temperature of the air, the light, &c. From our present point of view, drying oil, boiled with litharge or manganese, loses part of its importance, because it may be dispensed with for the second and third coats, and even for the first one if the natural drying is aided by the temperature. Moreover, pigments themselves may act as substitutes, as in the case of light colors, which are altered by yellows or browns, if the painter has derived profit from some of the observations indicated in this article. Thus linseed oil, exposed to the air and to light, becomes drying and loses its color; it may, therefore, be employed with white lead or zinc white, without impairing the whiteness of either. Since by associating oixde of zinc with carbonate of zinc it is possible to dispense with a drier, we have a new way of avoiding the inconvenience of colored driers, at the same time it gives a hope that new combinations of colorless substance will be found, presenting greater advantages than those just noted. My experiments demonstrate that the processes generally followed by color manufacturers for rendering oils drying—that is, by heating them with metallic oxides—are open to objections of waste of fuel and coloration of the product. Indeed I have shown—(1) that oil kept at a temperature of 70° C. for eight hours had its drying powers considerably increased; (2) that if peroxide of manganese be added to the oil kept at this temperature it becomes sufficiently drying for use; (3) that a very drying oil will be obtained by heating linseed oil, for three hours only, with 15 per cent. of metallic oxide, and at the temperature generally adopted by the color merchants. My experiments explain perfectly well the effect of linseed oil, or more generally speaking, of drying oil in painting. Indeed, when oleic acid is mixed with metallic oxide, it passes instantaneously from the liquid to the solid state, and there is no uniformity in the *ensemble* of the molecules of the oleate. The effect is different when a drying oil, absorbing oxygen, passes progressively to the solid state. The slowness with which the change takes place allows of the symmetrical arrangement of the oily molecules, which would appear transparent if there were not opaque molecules between them. But if the latter do not predominate, the arrangement is such that the painting is glittering, and even brilliant, because the light is reflected by the dry oil as by a looking-glass.

TURPENTINE NOT A DRYER.

Oil, or Spirits of Turpentine, is generally supposed to be a dryer, and is used as such, while in fact it is only a thinner and has no drying properties in itself. This has been repeatedly proved in various ways, but the following simple experiment will suffice: In two vessels of equal size and shape put equal quantities of linseed oil, and with one mix a quantity of spirits of turpentine. Allow both to be exposed to the same atmospheric influences and watch them. Very soon you will find the quantity in each vessel to be alike, showing that the turpentine has entirely evaporated, after which, if you can perceive any difference in the rapidity of the drying between the two, it will be in favor of what was originally the pure oil. When a mixture of linseed oil and spirits of turpentine is spread out over a surface, the effect is produced which has led so many to call turpentine a dryer.

The turpentine rapidly flies off, and the oil is left in a much thinner body than if it had been applied pure, and the air has so much the better chance to operate on it, but the turpentine has left nothing behind to aid the hardening or drying process. Painters like to use it because it makes the paint flow more readily, work easier and spread out better. For inside work it is desirable, because as the rule the object is to apply to the surface covered as little oil in proportion to the pigment used as possible, while for outside work the reverse is the case. Turpentine and benzine are almost identical in their mode of action, the benzine being the more volatile and escaping the more quickly. Neither should be used for the outside of a house, but for the inside they answer not only the purpose spoken of above, but, as they evaporate a " flat " surface, as it is technically called, is formed, and this is generally more highly esteemed.

THE population of all the States in the Union, as compiled by the New York *Herald*, amounts to 49,302,144. The population of six of the territories, given at 563,990, swells the total to 49,865,142. The population of the four remaining territories will undoubtedly bring the grand total up to 50,000,000.

HOW GOLD LEAF IS MANUFACTURED.

No one who has handled gold leaf can forget the feeling of wonder or surprise which its remarkable thinness produced at first.

Familiarity takes away the surprise to a certain extent, but the results of the lightest breath of air usually give occular demonstrations of the fact that there was good reason for wonder.

The extreme malleability of gold has made it a prominent metal in the useful as well as in the fine arts. It has been calculated that from $1,000,000 to $3,000,000 worth of this precious metal is annually used on ornaments, in gilding, in lettering, edging of books, in sign and ornamental painting and in dentistry. Of course, the greater proportion of this is for the first-named purpose, although there appears to be a great amount used in the other industries. A comparatively small amount, however, is necessary to cover a great deal of space. A cubic inch can be hammered so as to cover a space 35 feet wide and 100 feet long, and 20 of our $20 gold pieces can be drawn into a wire that would reach round the globe.

The gold-leaf beater's art is one of the most surprising when the result is considered. The minute films are so thin as hardly to retard the light, and yet possesses all the brilliancy of color of the solid block of gold. Gold leaf is manufactured from gold of about 22 carats. It is first cast into a bar 8 inches long, 1 inch wide and ½ inch thick, the weight being about 35 ounces. It is then rolled out until it is about as thick as the finger nail. The "ribbon" as it is called, is then weighed into packages, or "beatings," of 2½ ounces each. These beatings are what the men first start to work on. A man will cut one of these beatings (of 2½ ounces) into 180 pieces, making the pieces about an inch square. He then puts them into a "kutch," which is made of prepared paper, the size being 2½ inches square. He lays these 180 pieces of gold between these papers—first a paper, then a piece of gold. He will then beat on the "kutch" with an iron hammer weighing about 48 pounds, until the gold is the size of the "kutch." These pieces are then cut into quarters and then filled into a "shoder," which is made of gold-beater's skin, the size being 4 inches square, and holding all the pieces, numbering 750. The gold beater's skin is made from a preparation of a small portion of the large intestines of an ox, and the prepared paper is, or may be parchment from calf-skin, rendered clear and white by a peculiar operation that gives it the appearance of writing paper, for which purpose it is used to some extent. The pieces are then beaten out in the "shoder" with a hammer weighing about 13 pounds, making them all 4 inches square. These pieces of "shoder leaves" (as they are now called) are cut into quarters making them 2 inches square, and in all 2,880 pieces or quarters of "shoder leaves." These are then filled into three molds; each mold is made of the same material as the "shoder;" the molds are 5 inches square and hold 900 pieces or quarters of "shoder leaves" each.

The molds are then beaten out separately with a hammer weighing about eight pounds, until the gold inside is very nearly square with the edge of the molds. They are then sent to the girls for booking. Each girl will then take a mold full of gold taking each leaf out separately and trimming the edges of the leaf off, making them 3½ inches square and as the leaves are cut, they are put into a paper book holding 25 leaves. The gold is then ready for sale; it is sold by the single book or by the pack, 20 books making a pack.

To make gold leaf easier to handle, a Yankee inventor has found a method of fastening the leaf in a temporary manner upon a piece of of very soft tissue paper, just a little larger than the leaf itself. Gold leaf thus prepared can be cut and lifted into place upon work with very little trouble and much less annoyance than leaf unmounted. As soon as the gold touches the gold-size upon the surface to which it is applied, the paper can be pulled and the gold left in the desired position. We presume practical gilders would laugh at such an invention, but it is certainly a great convenience to those who have only a little gilding to do, and consequently are not always in practice. Gold put up this way we think is less liable to get damaged in the book from handling than the plain leaf.

FIXED WATER COLOURS.

A new and important discovery is claimed to have been made by M. Mery, a Frenchman, which, if it prove to be true, will be valuable to the painting arts and trades. He has been experimenting a great many years, and he claims now to have hit upon the means of making and applying imperishable water colours. He does not explain what he uses as a vehicle for his pigments, but it is something which, while it will mix with water, is not soluble in it. Whatever it is, it renders the colours unalterable, and, as it becomes after a time as hard as cement or stone, they may be said to be indestructible. It can be applied to any surface suitable for ordinary oil or water painting, such as wood, paper, glass, stone, canvas, &c., and can be prepared so as to dry in a few minutes or remain moist for an indefinite length of time. It is suggested that possibly M. Mery has re-discovered the long-lost art of encaustic painting, which is supposed to have been applied and fixed by means of heat. It seems almost incredible that a paint can be applied by means of water, and yet not be affected by it afterward, but our authority is excellent for saying that such is really the case.

Artificial Glue.—A glue which can be well utilised for paper-making or finishing of textile fabrics has been lately introduced in Germany. The starch possesses the property of swelling considerably if it is treated with a hot solution of caustic salts, and a gluey mass is obtained which is moderately transparent and elastic, but insoluble in cold and slightly soluble in hot water. This process, which has been known some years, had to be abandoned. According to the *Papier Zeitung*, Herr A. Abadie prepares by means of alkaline or neutral chloride, like chloride of calcium, an artificial glue which is thick and more or less hard and easily dissolved in water. He can also obtain a hard mass, which is elastic, transparent, and insoluble in hot water. In this process magnesium chloride is used, to which a certain quantity of boiling water is added; the solution is left alone for some time, the liquor is drawn off, and a small quantity of sulphuric acid is added. It is necessary to use pure water for the operation. To the solution thus prepared starch is added, and the whole brought to the boiling-point, and kept for one hour at 90 deg. C. (194° Fah.) To the now clear liquor clear lime-water is added till all the acid is neutralised; the boiling is repeated, and a good artificial glue is obtained. After it has been left to cool, it can be removed in the solid state. For treatment of 100lb. starch, 100 lb. magnesium chloride and 1 lb. muriatic acid are taken along with the necessary quantity of water for the complete solution.

Printing Gold and Silver Colours on Carpeting and other Textiles.—Gold and silver designs for carpeting and oilcloths have been hitherto prepared in the following manner: The gold on silver were put in leaves or bronze powder on the designs, which were printed with a varnish of linseed oil or similar adhesive. The bronze thus attached did not possess much firmness, and the method was necessarily expensive. The method recently adopted by Wohlforth is as follows: The bronze powder is united at once to printing material. The liquid silicate of potash, or of oxide of sodium, answers this purpose. One part, by weight gold, silver, or bronze powder, along with two parts of the silicate, will give a prime colour, is easily transferable by rollers to paper, oilcloth, and woods and metals. The bronze thus printed dries very rapidly, and cannot be taken off by oil or water unless they are boiling. It bears light and heat equally well and especially sulphuretted hydrogen, which has such a destructive effect on bronzes put on in the form of powder. It is recommended to thin the mass by an addition of warm water, 10 to 20 per cent., so as to keep it from becoming too hard during the process of printing. An addition of glycerine or syrup, of 5 to 10 per cent., will be even preferable. The bronze color remaining on the printing forms can be taken off by warm water.

The Relative Cost of Motive-power.—Mr. Bissinger, M.E., at Carlsruhe, Germany, gives the following results as obtained in his examination of the several motors in regard to the relative cost per horse-power for each hour. It will be observed that the examination pertained principally to small motors. The relative cost per effective horse-power per hour is as follows:

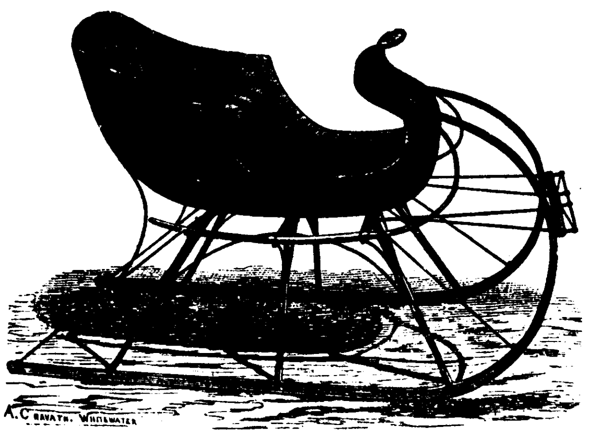
100 h.-p. steam engine	7.6
2 " "	44·3
2 " Lehman's caloric engine	26·5
2 " Hock's motor	40.0
2 " Otto gas-engine	26·4
2 " Otto Lang gas engine	26·4
2 " Schmidth's hydraulic motor, supplied with water from the city waterworks	95·00
2 " obtained by horses and a gin	45·00
2 " obtained by manual labor	200.00

A Novel Horseshoe.—A manufacturer in Berlin, Germany, is turning out a novel horseshoe made of malleable iron. It is not made solid. but has a deep and wide groove, into which tarred hemp rope is so firmly wedged that it cannot be withdrawn. It is so thick that it protrudes considerably beyond the rim of the malleable shoe. It is stated that the lightness of this horseshoe has gained for it considerable favor in Berlin.

A WESTERN CUTTER.

In this connection we present to our readers an illustration of a very popular cutter made by the Northwestern Cutter Works, Port Atkinson, Wis. The lower panel is bent in one solid piec . The seat panels are made in two pieces, bent corners and spliced in centre of back. In this manner all joints in the corners which are most liable to open are avoided and a fine and graceful appearance is produced. The irons are all drop-forged and the best steel shoes and Norway bolts and rivets are used. The runners are made $\frac{7}{8}$ + 1 inch, beams $\frac{7}{8}$ × $1\frac{3}{8}$ inches. The panels are painted dark green. The seat panel may be of French green or a very light shade of green, striped with gold, with fine line of white each side. Runners: dark lake, striped with two fine lines of straw or gold color. Scrolls may be placed in the corners, and the stripe drawn from them.

Trim with green cloth or plush. Plain carpet with figure. Patent leather cord welt, or cord welt made from the same material as the lining. Back finished with roll $2\frac{1}{2}$ inches wide at the top.



A USEFUL ATTACHMENT FOR KITCHEN SINKS.

One of the chronic troubles that periodically arises to plague even "the best regulated families," is the clogging of the waste-pipe connected with the indispensable kitchen sink. Even where the kitchen is under careful supervision, the trouble is sure to come sooner or later; but when, as is generally the case, the care of the kitchen is left entirely to the tender mercies of Bridget or Christine, the frequency of its occurrence need excite no surprise. An attachment to the sink of some simple device that will act as a peremptory check upon careless habits, would save considerable trouble.

We illustrate herewith a very simple attachment of this kind, which manifestly answers the purpose. The cut shows a kitchen sink into which is accurately fitted, making a close joint all around, a tray made of perforated iron (galvanized), brass or copper. This tray is so supported as to leave a space between it and the bottom of the sink, to permit the free exit of the strained liquids; and is likewise provided with handles, which permit of its convenient removal for cleaning, and with a box or soap-dish forming part of it.

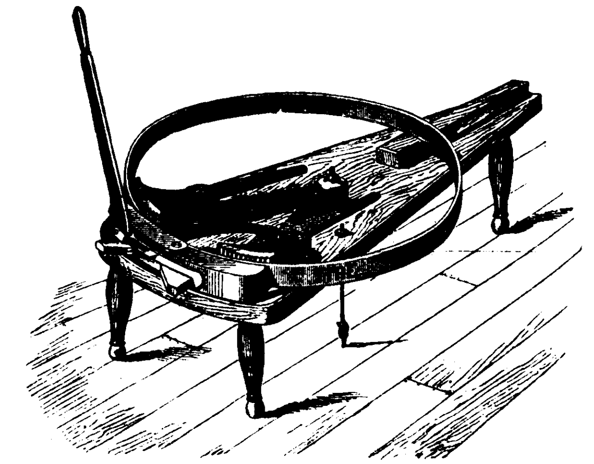
The object of the attachment is defined to be, to provide for the ready escape of the waste water; to prevent overflowing, arising from clogging at the mouth of the waste-pipe (which in this case may be clear, and not provided with the usual strainer); and to provide an extended filtering or straining surface to catch and retain all solid refuse, leaving it dry on the filter, from which it can readily be removed. The simplicity and utility of the device is too apparent to require further description.

It is proposed to commence, in Peterbrough, Ont., the manufacture of woodenware, such as pails, wash tubs, matches, etc., of a finer quality than any now manufactured in Canada.

The Grand Trunk Railway are erecting huge docks to receive coal at Port Huron and Point Edward, Ont. At Black Rock 90,-000 tons are already stored.

IMPROVED TIRE UPSETTER.

Our illustration represents very clearly a new tire upsetter, made by the Little Giant Manufacturing Co., of Millport, Chemung Co., N. Y. The manufacturers state that this machine was brought out with the view of supplying a strong and durable, and at the same time a low-priced, machine. This machine is said to be easy to operate, and so simple in construction as not to be liable to get out of order. By means of a powerful lever as shown in the engraving, any size or diameter of tire can be upset with equal facility and despatch. The method of operating is simple. The tire has only to be brought to a welding heat and placed in the machine with the heated spot between the jaws, which latter are then turned up tight against the tire; one movement of the lever is all that is required, when the upsetting is done. Those who may desire further particulars can obtain them by addressing the manufacturers as above.



Protection From Lightning.—A knight of the olden times in full armor was probably as safe from the effects of a thunder-storm as if he had a lightning-rod continually beside him; and one of the Roman Emperors devised a perfectly secure retreat in a thunder-storm in the form of a subterranean vault of iron. He was probably led to this by thinking of a mode of keeping out missiles, having no notion that a thin shell of soft copper would have been quite as effective as massive iron. But those emperors who, as Suetonius tells us, wore laurel crowns or seal-skin robes, or descended into underground caves or cellars on the appearance of a thunder-storm, were not protected at all. Even in France, where special attention is paid to the protection of buildings from lightning, dangerous accidents have occurred where all proper precautions seem to have been taken. But on more careful examination it was usually found that some one essential element was wanting. The most common danger seems to lie in fancying that a lightning-rod is necessarily properly connected with the earth if it dips into a mass of water. Far from it. A well-constructed reservoir full of water is not a good "earth" for a lightning-rod. The better the stone-work and cement the less are they fitted for this special purpose, and great mischief has been done by forgetting this.—*Nature.*

An Unknown Vandyck.—It is said that the art gallery in the old museum in Berlin is likely to be enriched with a valuable original of an old master. It appears that a certain Count, when looking over the effects of his deceased father, at his residence in East Prussia, discovered a "Christ" that had long hung in an unfavorable light in the work-room of the late Count. The painter was unknown, but an instinctive art feeling led the young Count to have the picture removed to his house in Berlin. Some time ago an Englishman appeared who offered £5,000 for the picture. In consequence, however, of his persistently pressing for an immediate decision, the Count became suspicious and declined the proposal. The Crown Prince hearing of the incident, sent some connoisseurs to inspect the painting, who pronounced it a valuable Vandyck, though the minor details might possibly have been worked in by his pupils. The management of the Berlin Museum is now in treaty for the purchase.

EFFECT OF STARVATION ON THE BLOOD.

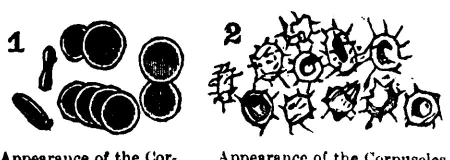
During the last hour of Dr. Tanner's 40 days' fast, some of his blood was withdrawn from the hand and subjected to a careful microscopic examination by Dr. P. H. Vander Weyde. It was found to be entirely different from healthy blood. The corpuscles, which are otherwise smooth and hard flat discs, with a depression in the centre, and of an average diameter of 1-3600th part of an inch, were found to be ragged, irregular and shrunk to the average of about 1-5000th part of an inch in diameter.

When blood is given time to dry on a microscopic slide, the corpuscles may lose their smooth appearance and become smaller by shrinkage, but in this case there was no chance to be misled into error by such a cause, as the blood was examined while perfectly fresh and the corpuscles still moving freely in the plasma.

This ragged appearance was so common in all of them that there was scarcely a smooth corpuscle among them, except the white ones, which had very nearly the normal size and were smooth. Their number, which ordinarily bears to the red corpuscles proportion of 1 to 400, was apparently increased. Occasionally the white corpuscles were seen clotted together in a way never observed in normal blood.

A further study of these abnormal red corpuscles showed that their rough appearance was generally caused by points projecting from their surface, and looking like a fungoid growth which covered them, while in many this growth appeared to be taking place at the expense of the corpuscle itself and living on its substance, as the corpuscles most densely covered were the smallest and the most irregular in shape; in fact some of them appeared disintegrating and breaking up.

We represent here some of the corpuscles as they appeared in the blood of Dr. Tanner, as seen and drawn by Dr. Vander Weyde, and at the side of the healthy blood the contrast is striking:



Appearance of the Corpuscles of Normal Human Blood. — Appearance of the Corpuscles of Dr. Tanner's Blood after 40 Days of Starvation.

It is a common law observed in organic substances that when a breaking up of the structure is impending, foreign living organisms spring up, and are sustained at the expense of the decaying organic body. Mold, and all kinds of fungoid growth, originate according to this law, while in infusorial life it reaches its highest development. In the latter case it appears intended to economize the organic materials of the structure, and in place of allowing them to discompose into their primary elements, and to be built up again by the slow and laborious process of vegetation under the influence of light, these organic materials are directly transformed into food for the larger inhabitants of water, and finally for fishes.

If the formation of fungoid spores, which is of a vegetable nature, also serves a useful purpose (which is probable), is as yet a question to be determined by further investigation; but certain it is that such a growth is not confined to large masses, but even found on the surface of such small objects as the corpuscles of the blood; this in fact has been recently investigated by microscopists, especially Korel, and such growth was found upon the blood corpuscles of patients when seriously suffering from various malarious diseases, such as typhus fever, etc., also in the last stages of consumption: and they agree that this growth exerts a destructive influence upon the body in which it takes root.

The appearance of Dr. Tanner's blood verifies this opinion. Very few, if any, corpuscles were free from the fungus, and all appeared to have suffered and shrunk in size, while many of them had become irregular in shape, and evidently were breaking up. As it appears to be the function of the liver to secrete the effete blood corpuscles, the liver of Dr. Tanner must have been taxed greatly, and this would explain his biliousness during the latter stages of the fast, when he often vomited bile with the mucous of his stomach.

In regard to the latter its digestive powers are phenomenal. Immediately after breaking the fast at the exact hour that the 40 days were ended, by eating a peach, he drank successively two large glasses of milk, ate half a watermelon, two beefsteaks, five apples, drank Hungarian wine, and had a good time generally, and was the next day already in good condition, gaining at the rate of five pounds weight every 24 hours.

The effect on the blood was very perceptible only 24 hours after breaking the fast. The fungoid spores had disappeared from a great many of the blood corpuscles, or, rather, perhaps, fresh ones had been envolved in the system, which is the most probable, as they looked as smooth and fresh as if they were entirely new. At the second day about half of the blood had become normal, while on the third day most all of the corpuscles were restored; however, there were here and there still some imperfect ones, irregular in shape, as if they were remnants, and even some of these were not yet entirely free from the fungoid growth.

Powers of endurance have been exhibited by various individuals, but we believe none have ever gone through such a severe and well authenticated test of physical endurance as Dr. Tanner, to whom at least the credit should be given to have practically demonstrated what man can endure when he, to use Dr. Tanner's own words, "once understands his own machinery and knows how to run it."—*Scientific American.*

STEEL FOR BOILERS.—The failure of the steel boilers of the Russian steam yacht *Livadia* has furnished the English technical journals the text for an extended discussion on the merits and demerits of this material for the purpose named. One of the foremost of these, the London *Engineer*, has arrived at the conclusion that English experience has shown that, with the exception of the plate manufactured by two firms, which it names, steel is unfit for the purpose; and it condemns Bessemer steel *in toto* for boiler-plate, giving its preference to that made by the open-hearth process. The *American Manufacturer*, in a criticism of these conclusions, makes some interesting comparisons between English and American experience in the use of steel for boilers. Our Pittsburg contemporary expresses surprise at the condemnation of boiler-plate steel, affirming that no such condemnation could be pronounced on the same product made in this country. There are, it alleges, four firms in Pittsburg alone, making steel boiler-plate, all of whose products give "uniformly excellent" results. The same journal asserts that the steel boiler-plate trade in this country is steadily growing, to the great detriment of the makers of iron boiler-plate; and that three fourths of the marine boilers and of the locomotive fire-boxes made in and around Pittsburg are made of steel.

A MACHINE, by which 600 pails can be turned out daily, the sides of each pail being made in one piece has been invented at Merrimacport, Mass. Round a block of wood shaped like a water-pail, the machine cuts off a strip of the requisite thickness for a pail, and of the same length the block itself is. A piece of the strip, of the right length for a pail, is then cut off, the edges, tongued and grooved, and a groove cut to receive the bottom.

—The mixture used by Mr. Hannay in the production of his first artificial diamonds consisted of 90 per cent. rectified bone-oil, 10 per cent. paraffin spirit, and 4 grammes of lithium. These substances were placed in a tube 4 in. in diameter, with a bore of ½ in., and after the open end had been welded up, the tube was subjected to a red heat for 14 hours.

—News has been received from the Belgian African Expedition up to date April 2. The elephant expedition was then a few marches from Unyanemba, the caravan being in good order and health. Mr. Cadenhead had lost one of his donkeys, but is convinced that his view of the donkey being proof against the attacks of the tsetse fly is correct.

—Two eggs of the extinct great auk were sold by auction in Edinburgh last week, both being purchased by Lord Lilford, one at £100, the other at 102 guineas—probably the largest sum ever paid for a single egg, with the exception of that of the moa, a single specimen of which was sold at the same place in 1865 for £200.

NEW PHOTOGRAPHS OF THE MOON.—Mr. George Berwick, it is stated, has taken a series of photographs of the moon on very sensitive plate—the bromo-gelatine. One of the plates shows three well-defined rings around the moon. Whether the rings are due to cosmical, atmospheric, chemical, or optical causes is not known.

THE FIRE RISK OF DEFECTIVE FLUES.

As the weather becomes colder and it is necessary to urge the furnace fires, there is each year what may be termed a fall and winter crop of fires, arising solely from defective flues and chimneys. The Philadelphia *Ledger* of a recent date chronicles the loss of an expensive school house in that city, owing to a defective flue, and a few days later another was considerably damaged from the same cause. Not long since, a fine depot was set on fire and narrowly escaped destruction because the builder did not know, or had forgotten the fact, that fire will burn wood, even when in the shape of a depot floor, and had allowed the beams to come within 10 or 12 inches of a coal fire. It seems rather late in the history of civilization to announce as a fact that fire will burn wood, and all that is necessary to set the wood on fire is to heat it sufficiently. Yet the statement almost loses its sarcasm when we see how closely flues and stoves are placed to floors, beams and wooden partitions, and one feels moved to make the statement in good earnest as an unknown truth. When a brick flue passes near woodwork there is a double danger. First there is the constant corrosion of the mortar by the gases from the fire. Where wood is used as a fuel, the steam and pyroligneous acid, or creosote, have a very destructive influence upon the mortar, and if the flue is long, or special attention is given to economy by burning the fuel with the drafts nearly closed, the condensation of the acids and tarry matter will be very great, and the danger to the chimney great in proportion. It is quite difficult to find a modern chimney top where the mortar is not largely eaten away by this corrosive action, and it is not unusual, in making a careful inspection of a chimney, to find holes in many places inside a building. The second danger arises from the fact that when wood is exposed to a considerable degree of heat it undergoes certain chemical changes, parting with a portion of its water, and is then in a condition not unlike tinder. It takes fire at a much lower temperature than ordinary wood. According to the testimony of experts it would seem that when in such a state a match will give a suffiient heat and blaze to set a heavy beam on fire. It is therefore the height of folly to allow wood to come near enough to a flue to be heated by it. The heat chars the wood and prepares it to take fire at a spark, and the chimney is liable to be corroded into holes and thus furnish the necessary spark to kindle the fire. Wood in this condition, as might be supposed, burns with extreme rapidity, and is extinguished only with great difficulty.

Where metal flues are used for leading smoke to a chimney, the danger from heating the woodwork is greatly increased, on account of the greater radiation from them. They are readily corroded, and where holes make their appearance there is no certainty that some day there may not be an escape of fire. Usually there is an inward draft into the chimney, so that the danger seems to be small. But it not unfrequently happens when the dampers are closed or fresh fuel has been put on and carbonic oxide is escaping, that the opening of a furnace door causes an explosion of the gas which may extend some distance along the flue and be attended by a flash of flame from any of the larger openings. Several churches in Brooklyn have been destroyed by fire within the last ten years, under circumstances which make it not improbable that something of the sort may have taken place. A defective flue is as inexcusable as it would be to rest a stove-pipe upon an unprotected wooden beam.

A great many fires result from hot-air flues. Because the heat in them is never greater than that of melting tin, and because they are not in actual contact with wood, it is taken for granted that there can be no danger. Wood which has undergone the slow charring process that we have described, not only burns easily, but can be made to take fire without a greater heat than that due to melting tin, and we have heard of cases, which we consider perfectly well authenticated, where a heat of 212 degrees continued a series of years, has, without the presence of even a spark, set boards and beams on fire. The folly of those who put up hot air or steam pipes to run in contact with wood floors, beams or partitions, is little less than criminal.

When galvanized iron pipes are used, special care should be taken to see that corrosion does not take place very suddenly. If a stove or furnace pipe "sweats" or "drips" very much, frequent and careful inspection is needed to see that the pipe is not eaten into holes. When a faulty length is found, it should be removed at once. Next spring may be too late. In some parts of the country, notably in the eastern portion of Massachusetts, it is very difficult to prevent the rapid corrosion of stove pipe of all kinds; hence the greatest care should be taken in such localities to see that all pipes are in good condition not only when they are put up in the fall, but during the winter also they should be inspected to see that no thin places have given out.

Few persons will credit the degree of heat to which the air in large hot-air furnaces sometimes rises. It is quite commonly believed that 190 degrees is about the limit, and that from 100 to 150 degrees is the rule. We are not prepared to say that this is not generally the case, but we do know that there are thousands of furnaces all over the northern part of the country where the hot-air flues frequently attain a temperature of from 440° to 500° F. It is not at all difficult with most furnaces, especially if they are a little too small for their work, to bring the flues in the immediate neighborhood of the furnace up to the melting point of tin 440 degrees. The lessons to be learned are these: Wood will burn, and furnace flues are amply hot enough under some circumstances to ignite it; chimneys may work nicely, and yet have openings large enough to permit the escape of fire in case of gas explosions, and in any case it is best to be perfectly sure of the conditions of chimneys and flues not only in the fall, but all through the season during which they are to be used.

VERY WONDERFUL PLUMBING WORK.

The funny man of the *World* gives the following curious account of the roofing of St. Peter's at Rome, Italy:

An interesting contest has been begun at Rome, upon which all civilized mankind will bend an anxious and hopeful eye. The Pope has tackled the plumbers! In 1863 Pius IX gave orders that the cupola of St. Peter's should be recoated with lead, upon the distinct understanding that the work should be completed in four years. The surface of the dome was divided into 16 sections, to cover each of which, according to the London *Telegraph* "nearly a million pounds of lead" is required. The experienced reader can readily imagine that when some hundreds of plumbers had a job of this magnitude on hand, and when each plumber's boy, on being sent home for some indispensable article which the plumber had carefully remembered to forget on leaving the shop in the morning, had to descend and ascend flights of stairs and ladders aggregating 470 feet in height; and when each plumber had to traverse these 310 yards of stairs and ladders twice a day there were greater openings for procrastination than ever presented themselves even in the dreams of the most fanciful member of the craft that gave his imagination full swing in making up a bill. After 17 years had been employed on the job, there still remained three sections to cover, while some of the old work doubtless was already in a gratifying state of dilapidation. Leo XIII, however, had stirred up the plumbers with a long soldering iron, as it were and they have promised to have the work completed by the beginning of 1882, which, according to previous experience, means somewhat about 1891. The Popes have hitherto humbled monarchs and brought hostile nations to their knees, they have not hesitated to deal determinedly with plagues of locusts and menacing comets, but this is the first time to our knowledge that the supreme pontiff has tackled a plumber. As unhappily His Holiness has none but spiritual weapons at his hand, and the plumber in the words of Job, laugheth at the shaking of an excommunication, the experiment cannot be conducted with as much certainty of a triumphal solution as if these were the good old days of the gibbet and the stake.

THE WARNER OBSERVATORY AT ROCHESTER, N. Y.—The new telescope for this observatory will be twenty-two feet in length, and its lens sixteen inches in diameter. Besides having the third telescope in size heretofore manufactured, the dome of the observatory will have new appliances for specially observing certain portions of the heavens. With the ample endowment due to Mr. H. H. Warner, it is the intention to make this the finest private observatory in the world. In the past, Professor Swift has labored under many disadvantages, and met with many obstacles in finding the new comet. This observatory is to be specially devoted to discoveries, which, it is said, there is reason to look for in the near future.

THE largest casting ever made in the United States was turned out at the Black Diamond Steel Works, Pittsburgh. The casting was an anvil block for a 17 ton steam hammer, and its weight was 160 tons. Five furnaces were built expressly for melting the iron, and seven hours were occupied in running the metal. The hammer will be the largest in the country, the next largest, of 10 tons, being at Nashua, N. H. Four months will elapse before the block will be cool enough to handle.

PORTABLE BATH TUB AND WASH STAND.

The accompanying engravings represent a portable bath tub and wash stand combined, now being manufactured and sold by Messrs. B. G. Carpenter & Co., Wilkesbarre, Pa. As may be seen by examination of the elevation (Fig 1)., this article is a novelty, both in its original conception and in the manner of its construction. In one article of furniture there is included a marble-top wash stand and bath tub, hot water boiler and the plumbing necessary to supply the tub with hot and cold water and to carry off the waste. The design of the inventors in its construction has been to arrange it in such a manner that the water supply may be taken from ordinary pipes where it is used in houses connected with city water works, or when employed in the country, from a tank situated in the attic. The inventors claim that it is very simple, and may be satisfactorily operated by even a child. The working parts of the article may be understood by examination of fig. 2. K represents a heater, which may be used of the style shown, or in place of it an oil, gas or vapor stove may be employed. J represents the hot-water boiler, which covers and surrounds the heater K. G represents the hot-water cock communicating with the bath tub. M represents the supply of cold water to the bath tub. B represents the wash basin attached to a marble slab on the wash stand. C represents a ball cock to supply and regulate water in the boiler. J D is a catch pan or waste from wash basin. B E is a waste pipe from the bath-tub F. In locating this article of furniture in the house, reference, of course, must be had to the situation of a chimmey with which to connect the stove. The construction, however, is such that the pipes may be attached to the stove through the side or through the back. Not having had the opportunity of personally examining this article, we are unable to comment upon it as we would be pleased to do had we witnessed its operations. We have no doubt, however, that such an article can be made to answer a good purpose, especially in places where an elaborate system of plumbing is out of the question. We learn that quite a demand for the combined bath-tub and wash-stand has already been created, and we are assured by the manufacturers that the same is giving entire satisfaction.—*From Metal Worker.*

DESIGN AND WORK IN CABINET FURNITURE.

I this week present our amateur cabinet makers with a sketch of a wall book-case or whatnot. This is a piece of parlor furniture that is fixed to the wall with screws, or even hung up on two strong nails driven into the wall. It is a series of four shelves of the shape shown in plan Fig. 3. The job may be made in pine, stained and polished, or in mahogony to suit the furniture. Of course, it may also be made in any other suitable wood, as the maker may fancy.

Four shelves are made 3ft. long, 10 in. broad in the centre, and ⅞in. thick. They are supported by two upright back straps, 2½in. broad and ⅞in. thick. These are stop-chamfered between the shelves, and finished at the ends, as shown. The shelves are let into these straps about a quarter of an inch, and screwed from behind. The six front pillars are 1½in. thick at base and cap, and are turned throughout, with tenons to fit into round shelves in the circular corners of the shelves. Underneath the lowest shelf are two brackets. See Fig. 2.

Over the ends of each shelf are fence rails with their ends let into the base of the front pillar, and the opposite ends into the back straps. These fences are 2 inches high, and are cut on the upper edges into semi-circles of 2 inches diameter. A ⅞-inch hole being bored through the centre of each circle, a similar fence runs along the back of each shelf. These are to prevent the books or other articles touching the wall, as the case has no back. These latter fences are nailed to the back edges of the shelves; they help to prevent the shelves bending when weighty articles are placed thereon.

This article is used for books, ornaments or other articles, as the owner may have need. It is a very useful article, and may be made by any amateur having tools, as its construction is exceedingly simple. It is specially adapted for small rooms, as it hangs on the wall, taking up no floor space.

I will next week show a wall cabinet, with shelves for fancy books or ornaments.—A. Cabe, in *Design and Work.*

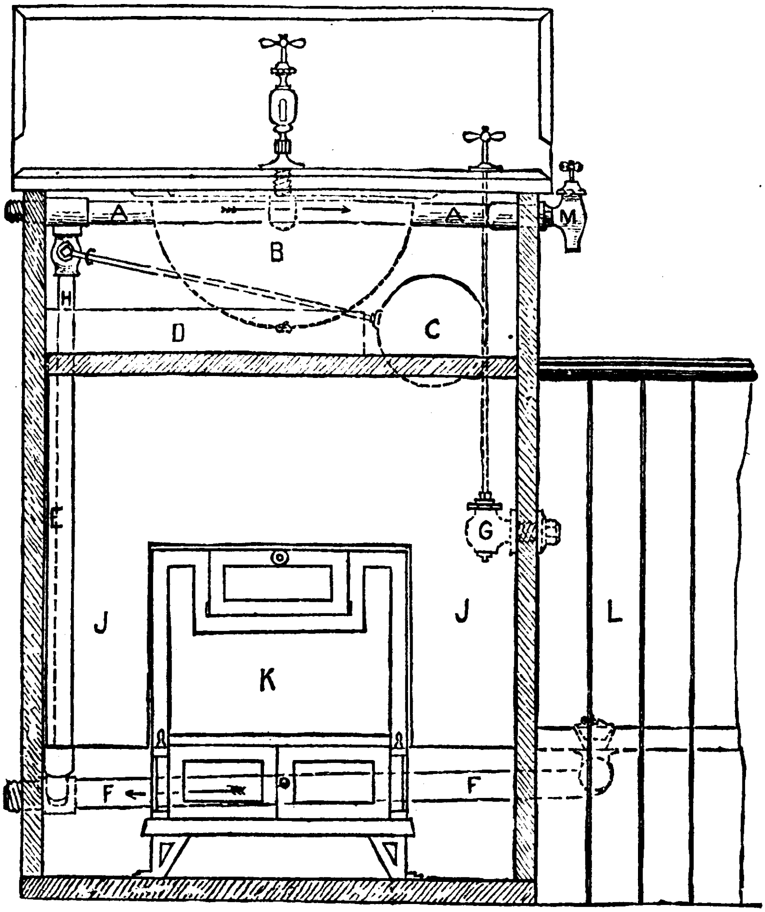
Rapid Work.—On the night of September 1st, 739 steel rails were rolled in the rail-mill of the Bethlehem Iron Company in 700 minutes.

WATER AND CREOSOTE IN STOVE PIPES.

The question frequently arises as to the cause of the wet or creosote running down stove-pipes, and what remedy may be employed. This difficulty is particularly annoying when it happens that the joints or lengths of pipe are so arranged as to throw all the gathered moisture outward, thus staining and disfiguring the pipe. An explanation of the trouble is readily understood, and in part it may be avoided. Almost all fuels commonly used in stoves contain a large amount of hydrogen in some form, usually in combination with carbon, and passing under the name of hydro-carbons. When a hydro-carbon is burned in air the results are water from the combustion of the hydrogen, and carbonic acid from the burning of the carbon. Usually the water makes its appearance, when the smoke is cooled a little, in the form of steam or vapor; a little further cooling and it takes the form of water. Those of our readers who have used kerosene stoves for heating small rooms have doubtless noticed the quantity of moisture which soon collects in cold weather upon the windows. This is the result of the combustion of the hydrogen coatained in the hydro-carbons of the kerosene, the steam being condensed upon the cold surfaces. Wood contains, besides a considerable amount of the hydrocarbons, a large percentage of water, even when very dry. When wood is slowly heated, besides the water, acetic or pyroligneous acid, tar, &c., are given off, the whole forming the black, disagreeable liquid usually called creosote. When a brisk fire is kept up in a stove where wood is burned, all the steam, tarry matter, &c., usually pass off into the air before they have time to cool and run down the pipe. If, however, the pipe is very long, the smoke is pretty likely to get cooled on its way out, and then the nasty dripping begins. This often takes place when the fire is first lighted, and lasts only for the little while necessary to heat the pipe. When a pipe drips after the fire is well started and the drafts closed, the remedy is quite easy. A little register is put into the pipe near the stove and is opened whenever the drafts are closed. This allows a free circulation of air in the pipe, and the gases are carried out of the pipe at once, instead of moving along so slowly as to give ample time for condensation. The dripping when a new fire is kindled is a very serious matter, and we are not at all sure that there is any convenient remedy. Reversing the joints of pipe will not do it. With dry anthracite coal there is much less trouble than with wood, because the coal has little or no water in its composition, and if the fire is started with charcoal there is scarcely any steam to condense, and none of the tarry acid products. Here we may very properly give a word of caution to our readers upon the subject of dry fuel, and more especially of dry anthracite. To allow either coal or wood to be wet with snow or rain is a very great waste, the heating power of the wood being greatly reduced by the action of the water upon it, even when it is afterward dried. In preparing wood for fuel it should be cut up and sawn while green, and at once stored out of the way of both snow and rain. In a word it should, "never see the sun" from the time the green cordwood is hauled to the shed. To attempt to dry wood in the stick we think very wasteful both of power needed for its preparation and of its heating qualities. Cordwood newly cut, put under cover and at once sawed to stove length and piled up out of the sun and rain, where there is an abundant circulation of air, is, according to our experience, worth about one-fourth more than dry wood prepared in the ordinary manner, and for our own use we would rather have one cord of such wood than two cords of dry cordwood dried in piles out of doors and then prepared for the stove. The two cords in heating power might be a little ahead of the first, but the satisfaction in using would more than make up the difference. When wet fuel of any kind is put into the stove, a great quantity of heat is wasted in converting the water into steam, which escapes up the chimney without giving back any of this list. If there is a little sulphur in the coal the presence of the steam greatly increases its destructive action, and stove and pipes are likely to show a rapid corrosion.

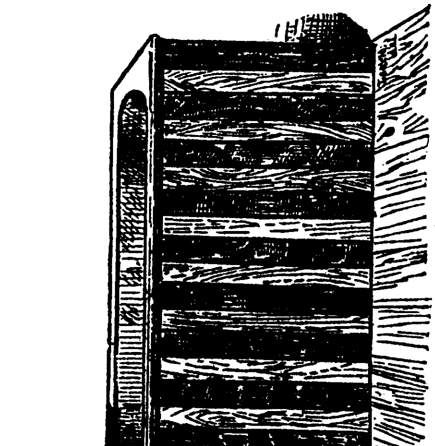
A Lump of Coal.—Forty thousand pounds of coal in one lump were carried over the Cincinnati Southern road recently, for the Cincinnati Exposition. It was taken out of the Soddy Coal Company's mine at Rathburn Station, twenty-three miles above Chattanooga.

The deepest perpendicular shaft in existence is the Adelbert shaft in a silver-lead mine in Przibram, Bohemia, which is 3,280 feet deep. Twenty years ago, a mine in Hanover reached a depth of 2,900 feet, while there are numerous shafts that reach 2,000 feet.



Portable Bath Tub and Washstand. = Fig. 2.—Section showing the Working Parts.

Fig. 2.—End.



Portable Bath Tub Washstand.—Fig. 1.—Elevation.

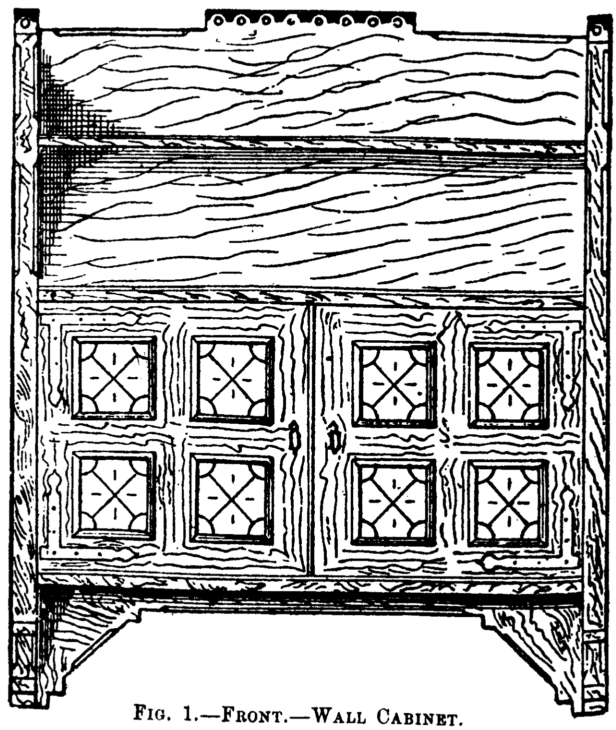


Fig. 1.—Front.—Wall Cabinet.