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CANADIAN MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 6. DECEMBER, 1878. No 12.

IN closing the last number of the sixth volume of the CANADIAN MECHANICS' MAGAZINE, we cannot but express our regret that the great depression which has existed in all branches of trade and manufactures, and which we alluded to in our closing number of last year's volume, not only continues to exist, but has increased to an alarming extent, particularly in the Province of Quebec. Failures still occur among our oldest firms, and manufacturers live in dread, from day to day, of receiving some unexpected blow from a source where least expected. The building interests, in Montreal especially, are more depressed than they have been for years past, and the number of mechanics appertaining to its many branches will, we fear, this year, have a hard time.

In our last number, in the leading article on Free Trade and Protection, we particularly alluded to many of the causes that have brought about so much distress in the United States, and there cannot be a doubt that until trade begins to revive in that country, it will remain stagnated here, although protection will benefit us to some extent. We fervently hope that the coming Spring will bring with it better prospects, and trade become established on a firmer basis than it has been for some years past. Too much credit has been the ruin of the country, and honest men have had to suffer.

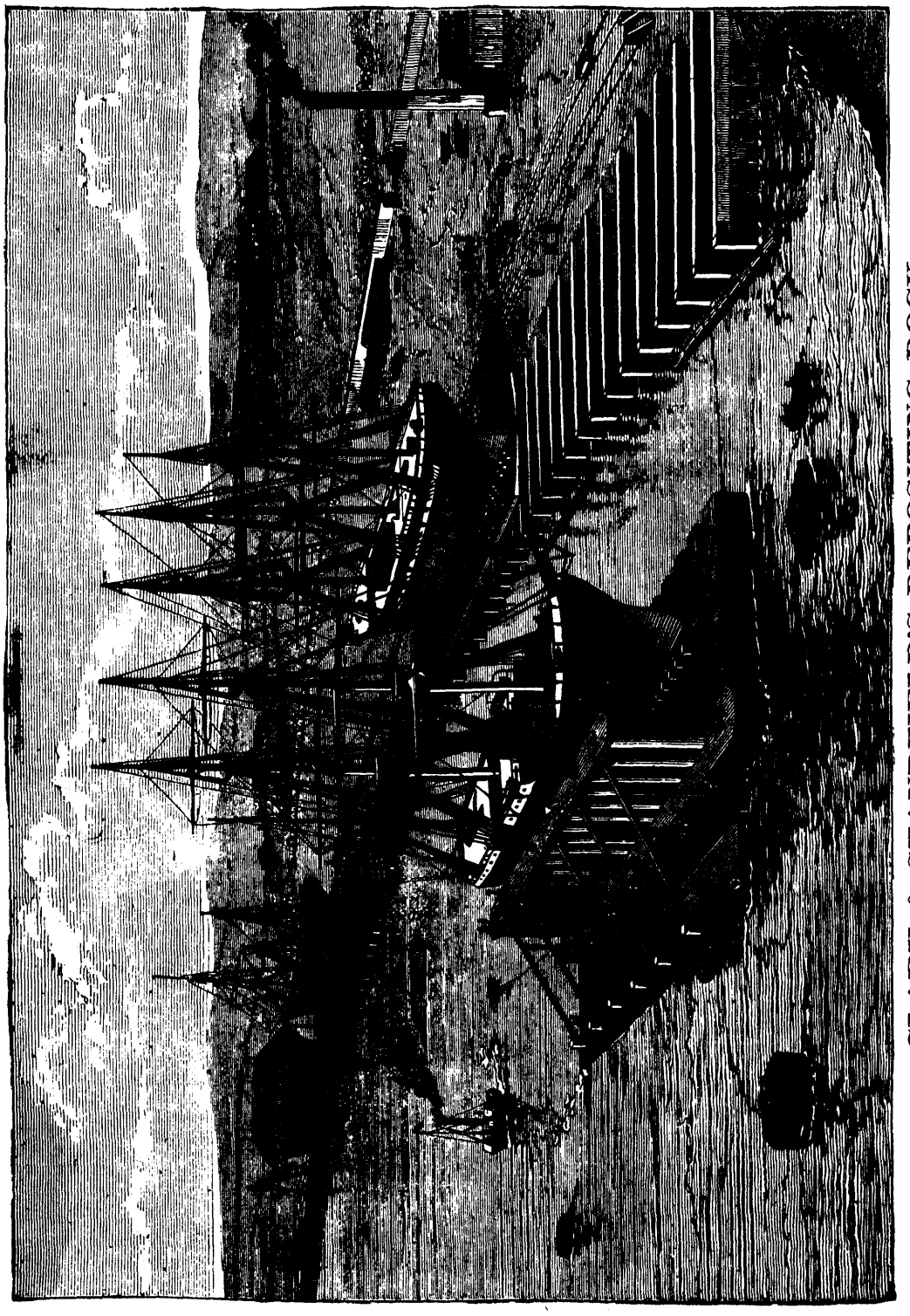
As a matter to be expected, all publications have suffered from the hard times, and perhaps none more so than scientific and mechanical papers; but we are happy to state that our subscriptions this year have increased nearly two fold, with every prospect of a large addition during the current year. We shall commence the seventh volume with an addition to its title, under which we hope it will grow and prosper in this country, and be patronized with as national and liberal spirit as its contemporary, the *Scientific American*, has been in the United States; which has enabled its publishers to bring it to its present high position among the scientific papers of the world. There is no just reason why we should not be taken under the protective wings of a *national policy*, as any manufacturing interests in this country, but the national policy we mean is the policy of the whole of the Canadian people, of every shade of politics, to take a pride in building up a national scientific and mechanical paper. It is only by so doing that we can expect to reach that perfection that its contemporaries have obtained. It is only by so doing that we can expect to impart useful information from one part of the Dominion to the other on such subjects as relate to our mines, forests and other resources of the country — our public works and manufactures — our progress in art, architecture and mechanical improvements — and the useful inventions patented in this country.

It will be perceived that in this number we have partially classified its subjects, which we believe will give much satisfaction. This is the only scientific magazine published in this form. Almost every reader hereafter will readily find that part of subject matter relating to his own line of business. We have done this at the express wish of a large class of our subscribers. Thanking our kind readers for their past support, and hoping for a continuation of their favor, we wish them all a happy New Year with the fond hope that it will bring with it benefits to all.

THE SCIENTIFIC CANADIAN AND MECHANICS' MAGAZINE.

As this Magazine will be published for the future under the above title, we offer a few explanatory remarks why this change has been made. Had there been a sufficient number of reading mechanics in the Dominion to support a paper relating almost entirely to mechanical matters, we should not have deemed any change in the title either necessary or desirable, but, as it so happens that one half of those who follow mechanical trades in Canada are French Canadians, it will be readily understood that the remaining half are by no means sufficiently numerous to support a paper whose subjects might be entirely mechanical, when we know it to be a fact that only a small percentage of the latter are reading

[*Continued on page 360.*]



CLARK & STANDFIELD'S DEPOSITING DOCK.

GIVING GENERAL VIEW OF DOCKING AND REPAIRING ESTABLISHMENT AND THE WORKING OF THE INVENTION.

FLOATING DOCKS.

Nothing, perhaps, can be considered of more vital consequence to the Dominion of Canada than the improvement of her natural water ways, and the cheapening, to the greatest possible extent, of the cost of transporting the products of the great West to their markets in Europe. It has, therefore, been the aim and end of every government, not only to increase the carrying capacity of our canals and attract traffic to the St. Lawrence route, but also, by all means in their power, to improve the great outlet by the Gulf. Failing this, all money expended for the former purpose would be simply thrown away.

Notwithstanding, however, all that has been done of late years to minimize the danger of the passage to Quebec and Montreal by the improvement of the channel, multiplication of lights and other means, the high rates of marine insurance necessitated by the frequent disasters to shipping will always tend strongly to counterbalance the advantages in point of distance, and militate strongly against Quebec and Montreal in their competition with New York, Boston, and other shipping ports in the United States. One great difficulty which has yet to be met is, that should a vessel sustain some slight injury, there, is no dock accommodation in which she can be repaired without discharging her cargo, and this, should such an occurrence take place near the end of our short season of navigation, becomes a matter of detention and very serious loss.

So much so has this been felt that, as we need hardly remind our readers, the Imperial Government is about to undertake the construction of a graving dock at Quebec.

We have been led to these considerations from the perusal of the pamphlets issued by Messrs. Clark, Standfield & Co., of London, Eng., descriptive of the "Depositing Dock," and "Double Power Floating Dock," invented by Mr. Latimer Clark, C.E., and Mr. Standfield, and, as the substance of these is of great interest, not only to those interested in navigation, but also to the public at large, we make no apology for laying it before our readers.

The first mentioned, or "depositing dock," has been devised to meet the requirements of busy ports where a number of vessels of varying size may require to be docked, and presents this peculiarity that with but a single dock, used in combination with fixed stages, upon which the vessel is deposited high and dry, for examination or repairs, an indefinite number of vessels can be docked, their number being only limited by the length of staging provided for their reception—its first cost, with that of the staging sufficient to accommodate several vessels, not exceeding that of a stone dock.

This depositing dock is formed of a series of fingers or pontoons, upon which the vessel is raised, all rigidly connected at one end, somewhat like the teeth of a comb, to the lower part of a strong vertical side, which is practically an enormous tubular girder, and of such a height as never to be quite submerged even when these pontoons are sunk sufficiently to allow a vessel to float over them.

Both the side and pontoons are divided up into many separate water-tight compartments, a certain number of which are permanently sealed up so as to render it impossible to sink the dock either by accident or design, and as the pressure of the water upon the submerged pontoons is sometimes equal to 15 lbs. the square inch, a perfect framework is arranged within them and the side to withstand this pressure. In addition to this, the middle of the pontoons, upon which the vessel rests, is strengthened by extra frames and bulkheads.

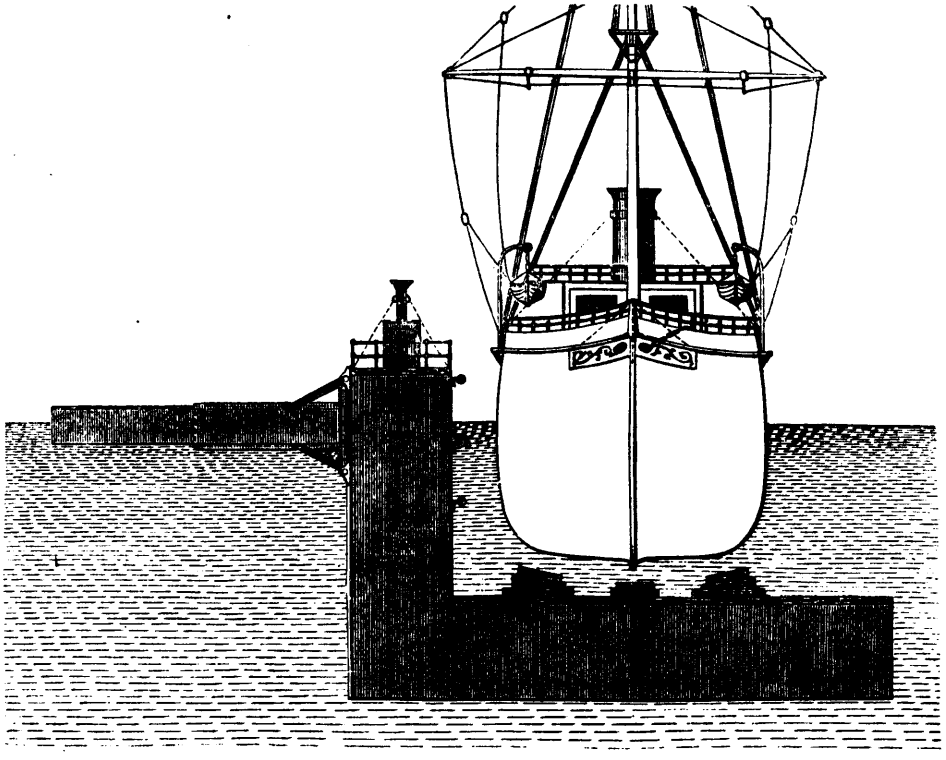


FIG. 1.—DOCK SUBMERGED WITH VESSEL OVER IT, READY TO BE RAISED.

As the dock has but one side to it, it is necessary that special means should be adopted for keeping it horizontal during the process of raising and lowering.

This is effected by the "outrigger" which is a broad shallow pontoon, divided into several portions and compartments, floating on the surface close alongside the dock, and loaded down by ballast to about half its depth at the time of flotation, each portion of this being attached to the dock by slides moving up and down in H-shaped irons running the whole height of the side. By this arrangement the outrigger and dock form practically but one structure, which can only roll by either the vessel or the side of the dock rising or sinking in the water.

The different apparatuses used for working the dock present

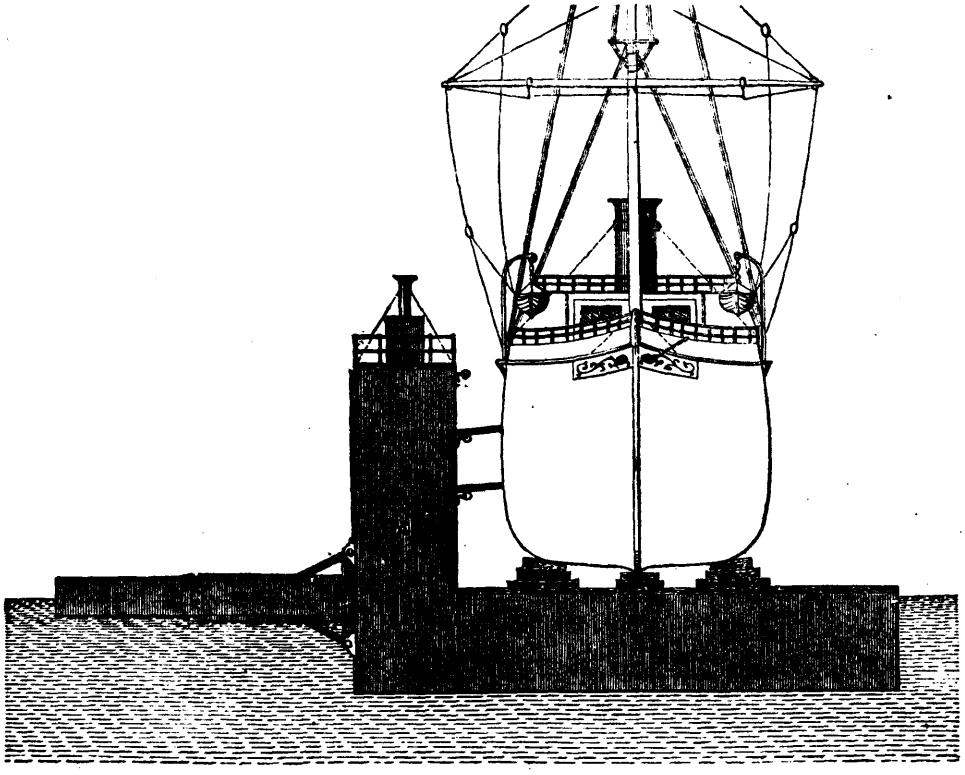


FIG. 2. DOCK-FLOATING, WITH VESSEL RAISED.

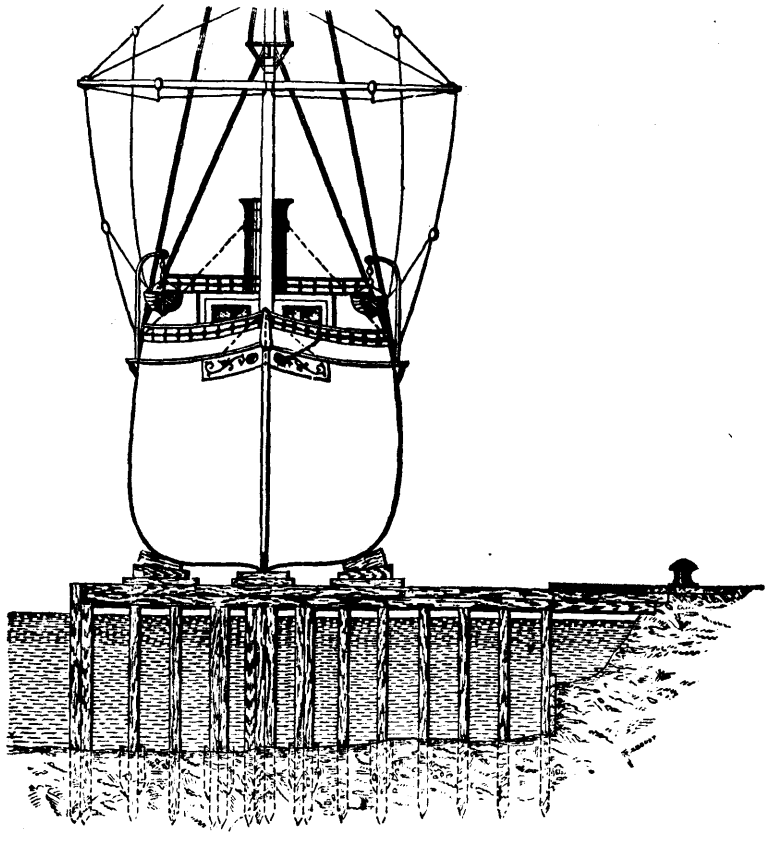


FIG. 3. VESSEL DEPOSITED ON STAGING.

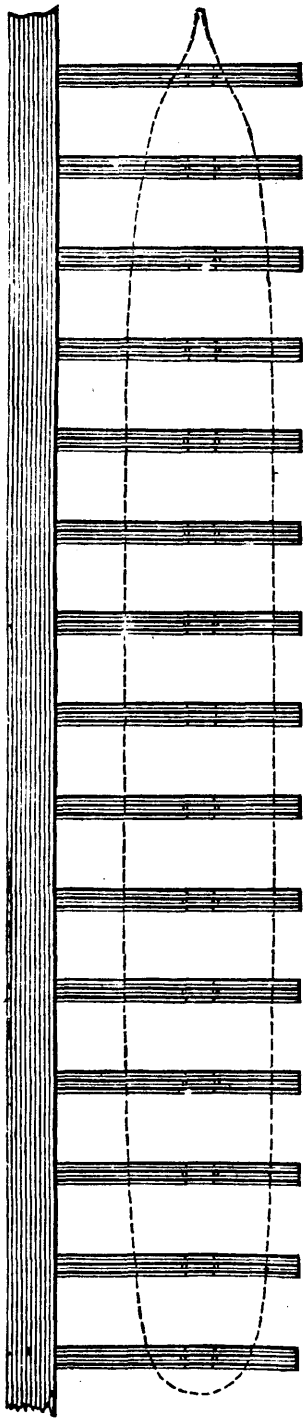


FIG. 4. PLAN OF STAGING.

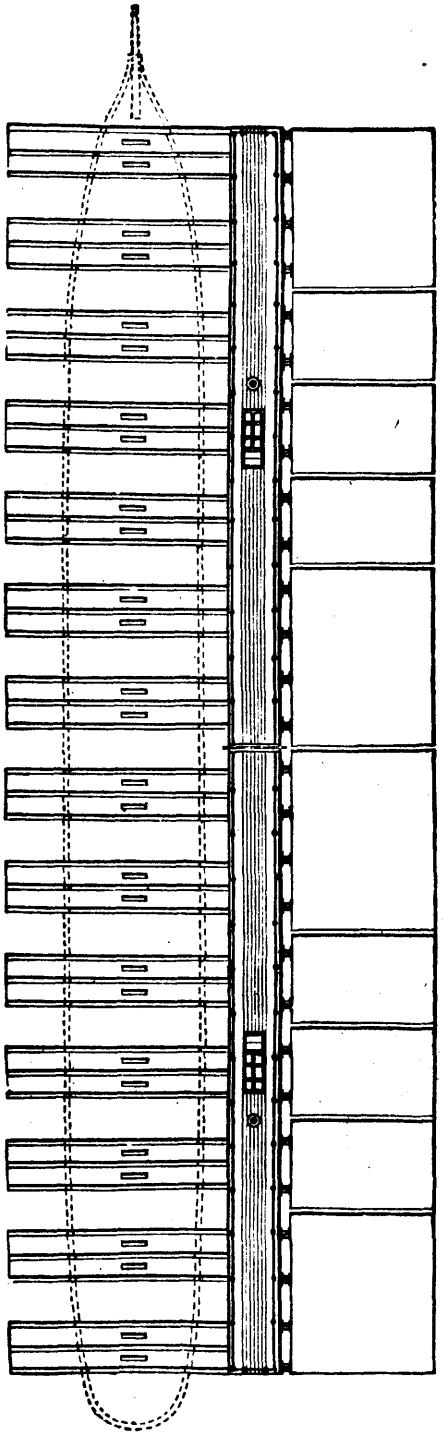


FIG. 5 PLAN OF DOCK.

no novel features, beyond those due to long and careful study as to their fitness, the pumps, engines and valves being contained in the sides of the dock and the pipes being divided into four groups controlled by valves, and corresponding to the four corners of the dock so that the level can be adjusted with the greatest ease, by the admission or expulsion of water at the several points.

The capstans for mooring or manipulating the dock are of the best make of Harfield and Co.'s construction. The flow pipes

These piers are about five feet broad, and usually from ten to fifteen feet apart, and the pontoons carrying the vessel upon them are arranged at corresponding distances, so as to readily float in between the piers.

The general view of a docking and repairing establishment shown in the full page engraving will give a very good idea of the working of the invention ; the side, for reference, being lettered A, the pontoons B and the outrigger C.

In the smaller cuts Fig. 1 shows the dock ready to raise the

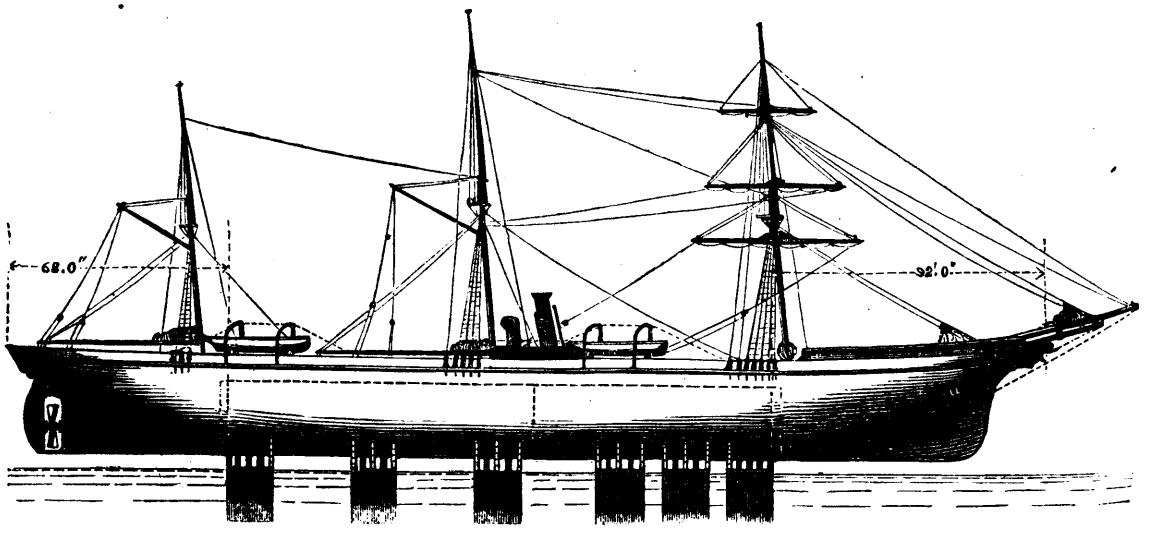


FIG. 6.—THE SS. "RUSSIA" AS ACTUALLY DOCKED ON TWO PORTIONS OF THE NICHOLAIEFF DOCK.

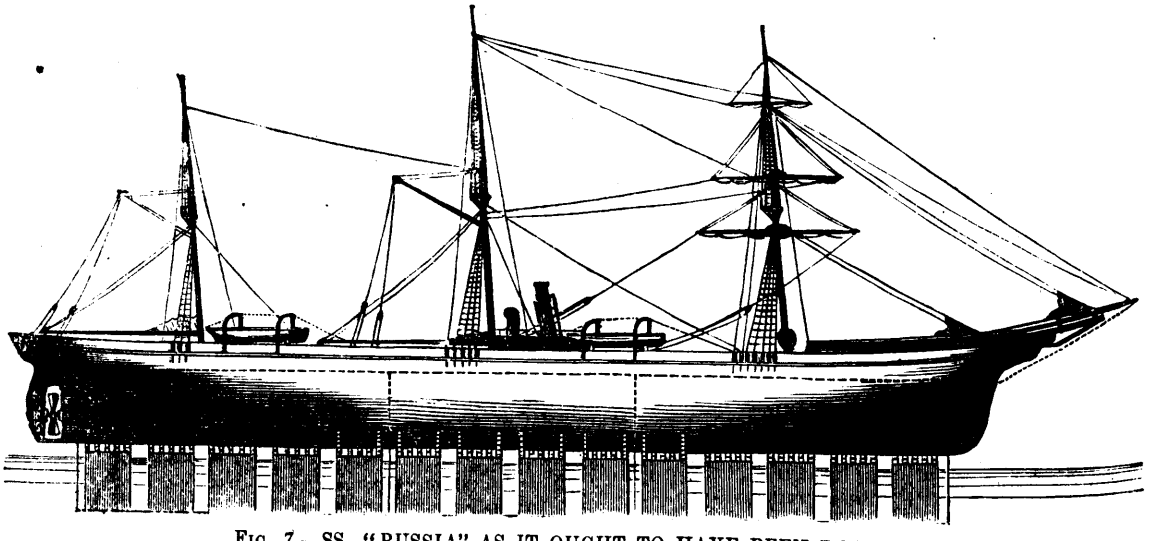


FIG. 7.—SS. "RUSSIA" AS IT OUGHT TO HAVE BEEN DOCKED.

throughout the dock are galvanized and all the minor accessories of the highest quality.

The horizontality of the dock is shown transversely by the outrigger and any deviation longitudinally determined by the gauges at the extreme ends of the dock.

The dock is made in two portions, each of which is complete in itself and provided with all appliances, so that each half may be used for docking smaller vessels, and is in fact a separate dock.

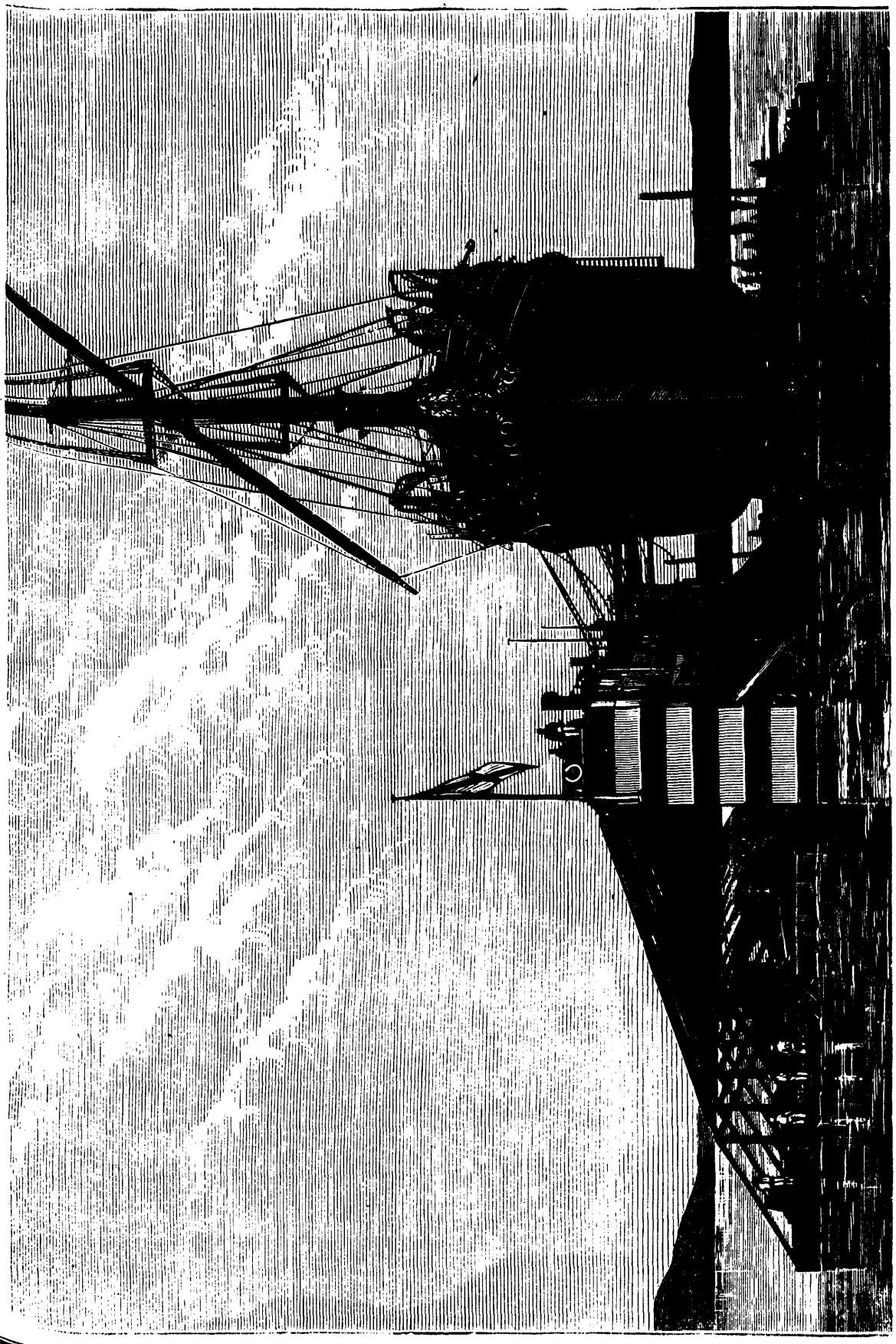
Although the dock may be considered complete in itself, its full merits are only brought into play when used in combination with the stages already mentioned for receiving the vessels.

These stages are quite independent of the dock, and are formed of timber or iron piles firmly secured in the ground and braced together, forming a number of narrow piers, on which the vessel rests.

ship brought over it to the position shown in Fig. 2, the way in which this is done being very simple, as when the vessel has been brought over the dock and secured in place in the usual way by ropes and shores, water is pumped in till the dock rises sufficiently to allow the vessel to bear firmly on the keel blocks.

Very broad sliding bilge blocks are then hauled forward under the bilges of the vessel so as to form an unusually broad and stable cradle, and the pumping is proceeded with until the vessel is fully raised. These sliding bilge blocks are a great improvement on any that have been hitherto employed; instead of being the ordinary width of a balk of timber they are framed together, and provided with slides and wedges so as to give a bearing width to the vessel of from four to six feet, and they slide

(*Continued on page 360.*)



THE SS. "RUSSIA" ON THE NICOLAIEFF DEPOSITING DOCK.

in iron grooves. It will be seen that one of these square bilge carriages will give four or five times as much support as ordinary blocking, and they are not liable to be displaced by rough water ever, when struck by seas in exposed positions.

For some special cases when loaded vessels have to be raised, the sliding bilge blocks are enlarged and provided with air-bags or water-bags made of indiarubber and canvas, enclosed in a strong cord belting, so that the whole sides of the vessel are supported on cushions as if they were in the water. In this way, vessels with loose grain or similar cargo can be safely docked even when fully loaded. The vessel when docked rests fairly on the pontoons (by which it is supported and not by the side of the dock), the outrigger giving the stability required.

The dock carrying the vessel, which is raised till her keel is a foot or two above the top of the piers, is then towed to the staging, and the pontoons floated in between the piers ; by admitting water the vessel is lowered on to the staging and the dock is then drawn out ready to receive another vessel.

The depth of water required between these stages is, of course, only that which is sufficient to float the pontoons, say from ten to fifteen feet, according to the size of the dock, but, at the spot where the vessel is lowered to receive the vessel, a greater depth, equal to the draught of the vessel added to the depth of the pontoons, is necessary.

It is evident that the operation of transferring the vessel from the dock to the staging can only be performed when the water is at a certain level, varying a few feet, more or less, which difference can be adjusted by the blocking.

The severest test that could have been made of the efficiency of Messrs. Clark and Stansfield's invention was afforded at the dock constructed by the patentees at Nicolaieff, the Russian Naval Arsenal on the Black Sea, which we illustrate on page 359. Military exigencies made it a matter of the greatest importance that the "Russia," a vessel of 334 feet in length, should be prepared for sea without delay ; it was therefore determined by the authorities to use the dock for the purpose of cleaning her, and this, although but a length of 174 feet on the side, was completed, and but six of the pontoons attached, the difficulty being still further increased from the fact that of these, three were spaced only five apart and the remainder twenty-five feet. Figs. 6 and 7 show respectively the vessel as she was docked and as she ought to have been docked.

In spite of all this, however, Capt. Goulaeff of the Russian Imperial Navy, the Government representative at the construction of the dock, reported that the vessel, although her estimated weight corresponded nearly exactly to the lifting power of the six pontoons used on that occasion, was lifted and her bottom scrubbed and painted down to the upper part of her keel.

Capt. Brovzin, the superintendent of the Nicolaieff Dock, who was formerly in charge of the establishment at Cronstadt, reports very favourably on its security and ease of manipulation, and specially notes the ease with which its submersion can be adjusted.

The advantages claimed by the patentees for this system of depositing docks and staging are, among others, that with one dock any number of vessels can be docked and deposited high and dry on platforms in convenient position for cleaning or repairs, each equivalent length of staging being equivalent to the building of another dock ; that as the vessels docked are usually deposited on a stage, the dock is always free for use, and can be transported from place to place, for the purpose of raising or depositing vessels at different points ; and lastly, that, if constructed in the first instance too small for the requirements of trade, the dock can at any time be enlarged at the same rate per ton as the original cost.

A PAINTING MACHINE.—An English firm shows at the Paris Exposition a novelty in the form of "Roberts' Self-acting Painting Machine," which will paint or varnish, without steam power, the window-blind laths of houses, the figures given being 60,000 running feet per hour. The flywheel spindle of this machine carries a pair of bucket grooved wheels, which in their rotation dip into a well or reservoir of the paint or varnish to be used, and then discharge the pigment on the lath inserted between small rollers. Equality of distribution is provided for by means of stationary brushes. Hoop iron intended for packing purposes, or bedsteads, can be treated in the same manner.

men. We have, fortunately, been indebted to a large number of our subscribers for support who are not connected with mechanical trades, and who take the Magazine for the varied, useful, scientific, architectural, and other matter contained in its columns.

In order, therefore, that the subjects on which the Magazine treats should be better known, we have given it a broader title which will embrace Science, Art, Inventions and Mechanics, and by this change we hope to introduce it more prominently to the notice of many, who, under its present name, have not been aware that it was a *scientific* as well as a mechanics' magazine.

CHURCH OF ST. MICHAEL AND ALL ANGELS, BALTIMORE, Md.

MESSRS. WATT AND SPERRY, ARCHITECTS.

The transepts and tower of this church are now being built, on the north-east corner of St. Paul and Denmead streets, Baltimore. The exterior walls will be of Falls blue stone with finish of a reddish brown stone from Longmeadow. The interior will be finished with open timber roof, the walls will be decorated with painting. The arches and band courses will be of colored brick and terra-cotta, with corbels, &c., of Amherst stone.

—*American Architect and Building News.*

WAGES IN ENGLAND.

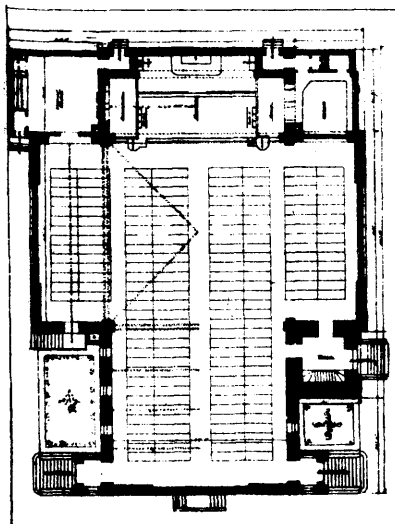
The Secretary of the Iron and Steel Association has received from a special correspondent in England the following particulars with regard to the wages paid there in April last :

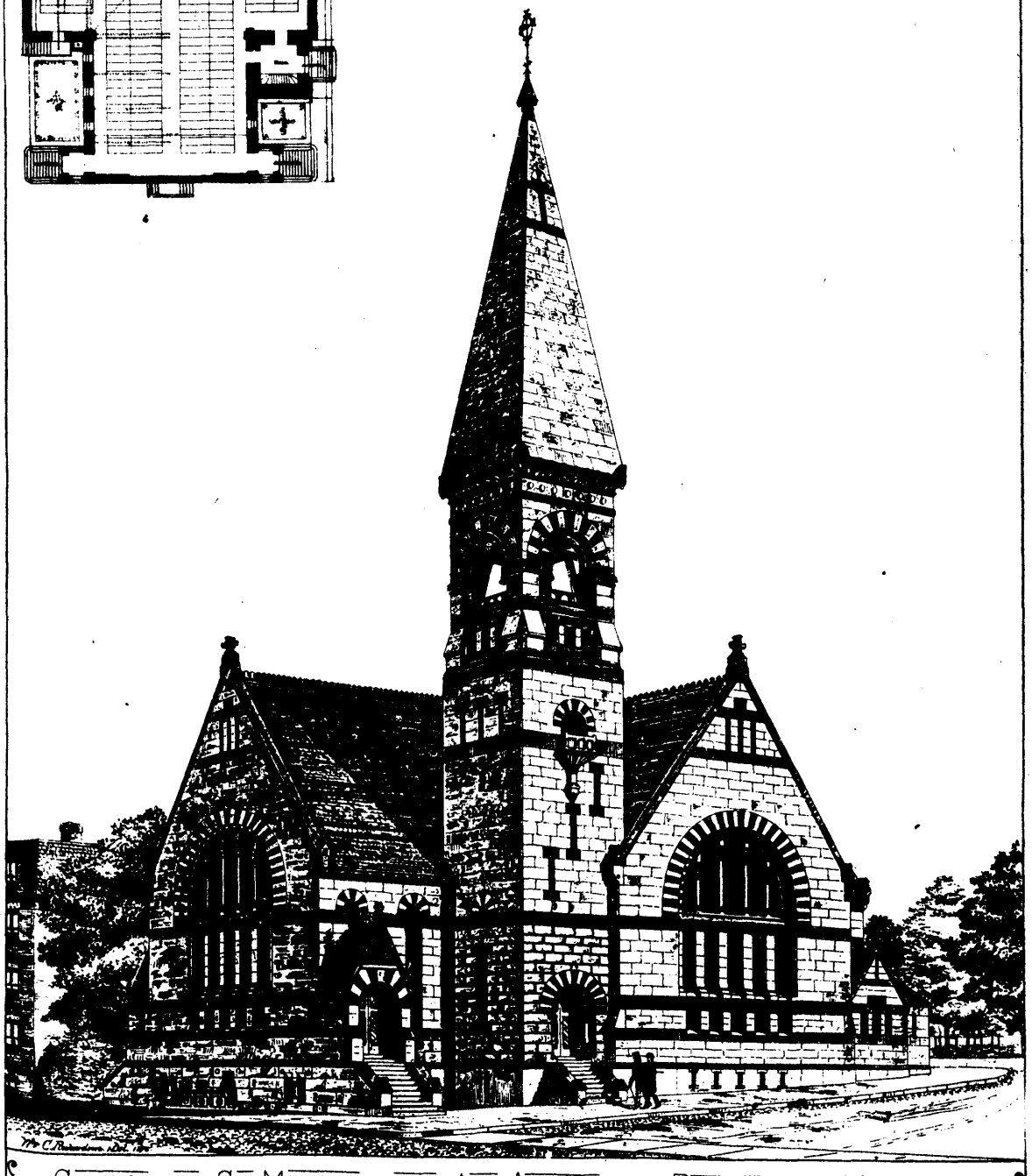
WAGES PAID EMPLOYES ON THE MIDLAND RAILWAY.—Engine-men, per day : first six months, 5s. 6d. — $1.34 ; second six months, 6s. 6d.—$1.58 ; four years, 7s.—$1.70 ; full pay, 7s. 6d. —$1.83 ; permanent shunter, 6s. — $1.46. Firemen, per day : first twelve months, 3s. 6d.—85c.; afterward, 4s.—97c ; passed as drivers, 4s. 6d. — $1.10. Guards or brakemen, per week : passenger, main line, 21s. to 29s. —$5.11 to $7.06 ; passenger branch line, 21s. to 25½s. — $5.11 to $6.09 ; freight, main line, 24s. to 30s.—$5.84 to $7.30 ; freight, branch line, 24s. to 29s.—$5.84 to $7.06.

WAGES PAID EMPLOYES IN THE NORTH OF ENGLAND IRON MILLS — Puddling grav iron and mixtures, per ton, 8s. 3d. — $2.01 ; prize money per week of full heats, 2s. 6d. — 61c.; prize money per shift to underhands for full heats, 6d.—12c. Heating rails, large mills, per ton, 1s. 4¾d. — 33c.; heating rails, small mills, per ton, 1s. 8¾d. — 42c.; reheating rails, large mills, per ton, 8¼d.—16c. Rolling rails, large mills, per ton, 1s. 9d.—42c.; rolling rails, small mills, per ton, 2s. 2¾d.—54c. Laborers, mills and forges, per shift, 2s. 9¼d.—67c.; laborers, blast furnaces, per shift, 3s.—73c.

OVER 2,000 farmers in Maine have taken hold of the beet-sugar enterprise, and are raising this root for the factory in that State.

TESTING THE STRENGTH OF CEMENT.—At the Paris Exposition there is on exhibition a machine for testing cement. To the upper end of a suitable cast-iron framing is hinged a bent lever, one end of which carries a heavy counter-balance weight. The other (and shorter end) has suspended from it the frame in which the block to be tested is placed. The lower end of this frame is acted upon through a link by a toothed quadrant, which can be partly rotated by a handle driving the worm which engages it. By means of a segment at the back of the machine, and a pointer driven by a small stud on the bent lever, the maximum attained elevation of the counterbalance weight is shown, and therefore by suitable marks the strain sustained by the block is at once known. It will readily be seen that the pulling motion is extremely even and gradual, so that the block cannot get broken by jerks. The two bolts which untie the two halves of the frame in which the specimens are tested are left very slack, by which arrangement the full test load can be applied, and at the same time the counterbalance weight can only drop a short distance when fracture takes place. The machine is simple and efficient, and a large number of manufacturers and users of cement have them daily employed at their works.





CHURCH-OF-ST MICHAEL-AND-ALL-ANGELS — BALTIMORE MARYLAND

WYATT AND SPERRY ARCHTS
BALTIMORE

From the *American Architect and Building News.*

POISONED, NOT DROWNED.

WHY SO FEW OF THE PASSENGERS ON THE "PRINCESS ALICE" WERE SAVED.

We submit that the error—wilful or accidental, whichever it may have been—of the captains of the two vessels was not the *causa causans* of the death of the majority of this multitude. It is simply incredible that, out of some eight hundred people who were suddenly submerged, not a dozen should have saved their lives by swimming, and it is equally remarkable that of those few none were actually under water a second. There must be, unless we are prepared to enunciate new canons of logic, a connection between cause and effect, and in this case it is more than evident that a very large number of persons able to swim succumbed. The blame, therefore, rests not only with the Princess Alice and the Bywell Castle, but with those who have rendered the waters of the crowded Thames absolutely deadly. In plain English, and it is impossible to be too positive with the fact staring us in the face, the six hundred and odd souls were poisoned. The entire sewage of the metropolis is discharged into the river at Barking Creek in a raw condition, converting thereby the stream into a common sewer. Now, the immediate effect of plunging a human being into sewage is stupefication and asphyxia. Captain Webb himself, if placed under such conditions, could not save his life. At the moment of the collision there was actually being turned into the Thames, in close proximity to the scene of suffering, a colossal mass of fermenting sewage, black as Erebus, effervescent with the vilest gases, and, so the chemists tell us, potent as prussic acid. Who can doubt, after this, the real reason of the awful mortality! The *a priori* argument is indeed incontrovertible, and it is verified amply by the product of experience. What, we would ask, could have rendered the task of identification so supremely difficult? What chemical force could have changed in about half an hour a bright olive dress to a dark brown, and what caused the almost immediate decomposition of healthy bodies? The answer to these queries is obvious. It was the same horrible compound which deprived these poor souls of what chance they would otherwise have had. One of the saved, we note, in his description of his brief experience under water, imagined that the blackness and disgusting impurity of the stream was to be attributed to the smoke from the Princess Alice. He was not aware, of course, of the cesspool into which he had been precipitated, nor of the fact that a few seconds more of submersion would have rendered him helpless. A very superficial examination however, of Barking Creek, with its two ominous columns of sewage, and of the quality of the water just below, would suffice to prove the accuracy of our contention that the true cause of death of these hundreds of people was sewage poison. For many years the Metropolitan Board of Works have been suffered to evade the common law, and to claim an immunity, granted to no other riverain town, from the just penalty which ought to accrue for the offence of polluting the river.—*Whitehall Review.*

SENSATION DURING HANGING.

A question has arisen which very few living persons are in a position to answer, viz., what sensations are experienced during hanging? Some of the few who have been able to give an account of their consciousness at so critical a moment, say that after one instant of pain, the chief sensation is that of a mass of brilliant colors filling the eyeballs. The *Quarterly Review* (volume lxxxv.) treating on this matter, says:—"An acquaintance of Lord Bacon, who meant to hang himself partially, lost his footing, and was cut down at the extremity, having nearly paid for his curiosity with his life. He declared that he felt no pain, and his only sensations were of fire before his eyes which changed first to black and then to sky blue. These colors are even a source of pleasure. A Capt. Montagnac, who was executed in France during the religious wars, but was rescued from the gibbet at the intercession of Marshal Turenne, complained that, having lost all pain in an instant, he had been taken from a light of which the charm defied description. Another criminal, who escaped through the breaking of the halter, said that, after a second or two of suffering, a light appeared, and across it a most beautiful avenue of trees." All agree that the uneasiness is quite momentary, that a pleasurable feeling immediately succeeds, the colors of various hues start up before the eyes, and that these have been gazed at for a limited space, the rest is oblivion. The mind, averted from the reality of the situation, is engaged in scenes the most remote from that which fills the eye of the spectator.—*All the Year Round.*

THE CARE OF SHOP TOOLS.

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

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

Machines should be mounted on stable foundations and run neither above nor below the proper speed required to do the work. Small tools demand as much care as large ones, and a careless or inexperienced workman will often spoil more than the amount of his wages in files, drills, chucks, reamers, taps, dies, calipers, wrenches and the like, unless closely looked after by the master mechanic. It is therefore very essential, in order to insure proper care of tools, that workmen know just how to use them. All small tools should be laid away systematically in a dry place when not in use. In large shops a room should be set apart for this purpose, and a man detailed to take charge of it and keep the tolos in good working order. There is no part of a large machine shop from which an outsider can form a better judgment of the general management than by an observation of the tool-room. The best economy is established by securing none but the best tools at the outset, for in the long run they will be found the cheapest. As a rule it is expensive trying experiments by purchasing tools of new and untried patterns or material. New machines and tools are often constructed so as to leave no reasonable doubt of their successful operation, but this is not invariably the case. It is always safe to buy those about the working of which there is no doubt. Second-hand machinery can often be obtained in good order at very low prices, if the purchaser has extra time at his disposal to loop it up, but when machinery is much worn, its value is questionable at any price. It is not only easier, but a greater satisfaction, to take care of good tools than of poor ones.

AN EFFICIENT DISINFECTANT.—A correspondent of the New York *Herald* says that the "chloride of lead is the cheapest and most efficient deodorizer and disinfectant known. As some neutralizing agent of this kind should be freely used at this time in every house, we give the process of preparing and using it as given in the *Herald*: To prepare a solution of chloride of lead on a small scale for family use, take one-eighth of an ounce of nitrate of lead and dissolve it in one quart of boiling water; then dissolve one ounce of common salt in five gallons of water, pour the two solutions together, and when settled pour off the clear mixed solution and keep well corked in a demijohn or jugs for use. A cloth wet with this and suspended in the room will neutralize all offensive vapors, and a little dashed into a privy, sink, drain or sewer will disinfect and destroy all noxious gases by combining with them. It is said to be in general use in England for purifying sewers; also for destroying the stench of bilge water in the holds of vessels.

THROUGH a mistake of our lithographer the wrong title was put to an illustration and specification for the plumbing of a house, in our last number, pages 350, 351. We were indebted to the *Plumber and Sanitary Engineer* for the article and drawing, and not to the *American Architect* as erroneously printed.

CHEMISTRY, PHYSICS, AND TECHNOLOGY.

PAIN.— "Pain" is an ache, or abnormal feeling, produced from an unnatural condition of the nerve or nerves afflicted, and in most cases it is induced by pressure, derangement, disintegration, or the imperfect circulation of the blood in or near them. Proof of the first and last: Rubbing over and near the sensitive nerves by increasing the circulation mechanically, will remove the annoyance.

TURPENTINE AS A DISINFECTANT.—Mr. Thos. Taylor, Microscopist of the Department of Agriculture, has an article in a Washington paper, from which we take the following: "Turpentine I also found to be a powerful deodorizer. A tablespoonful added to a pail of water will destroy the odor of cesspools instantly, and in the sick chamber will prove a powerful auxiliary in the destruction of germs and bad odors."

PATE DE BOIS.—In the Norwegian section of the Paris Exhibition, no less than 17 exhibitors send samples of the newly-developed "*pâte de bois*" industry. The article named is really the wood of the pine tree pulped, and formed into paper or carton by compression. The whole forms a most interesting exhibit, from the sheets of wood-pulp card-board to the highly-decorative cornices and panels, many of the designs being, moreover, both good and simple. This industry bids fair to become a very important item in the export trade of Norway. The export of this class of goods to France and England varies from 800 to 2000 tons per annum; and we learn that the demand is rapidly increasing every year.

RENDERING WOVEN FABRICS INCOMBUSTIBLE.—An accident in a match manufactory, in which a girl's clothing caught fire, lately induced M. Sieborath, of Dresden, to experiment upon processes for this purpose. Saturation with five or ten per cent. alum solution gave no good results; the stuffs burned with a flame after the impregnation, which, moreover, spoiled their appearance. On the other hand, a five per cent. solution of phosphate of ammonia proved quite successful; the impregnated clothes did not burn with flame, but were merely destroyed by carbonization. Lastly, a solution containing five per cent. alum and five per cent. phosphate of ammonia was tried on linen and woolen stuffs. The fabrics thus treated did not even burn when they had before been vigorously rubbed with gunpowder, The powder flashed, but left the stuff unconsumed. The clothes lose their incombustibility by getting wet or being washed. It is a disadvantage that they can be worn only in certain places, and that after washing a fresh impregnation is required.

PHOSPHORUS A CURE FOR SCIATICA.—It is not ordinarily wise to try remedies for effecting cures which one finds in the newspapers. But where the ingredients are such that no harm can arise from their trial, and the source from which the prescription emanates is likely to be reliable, the afflicted will gladly try almost any remedy recommended. Dr. Volquardsen reports in Schmidt's *Dictionary* and the *Pesth Medico-Chirurg. Presse*, both good authorities, from which the London *Medical Record* copies, a case of sciatica which lasted for two years and defied all treatment. He then arrived at the idea of trying the internal use of phosphorus, which he prescribed in doses of fifteen milligrammes (about one-fourth of a grain) three times a day. Three days sufficed to obtain a marked improvement, and three weeks brought a complete cure.

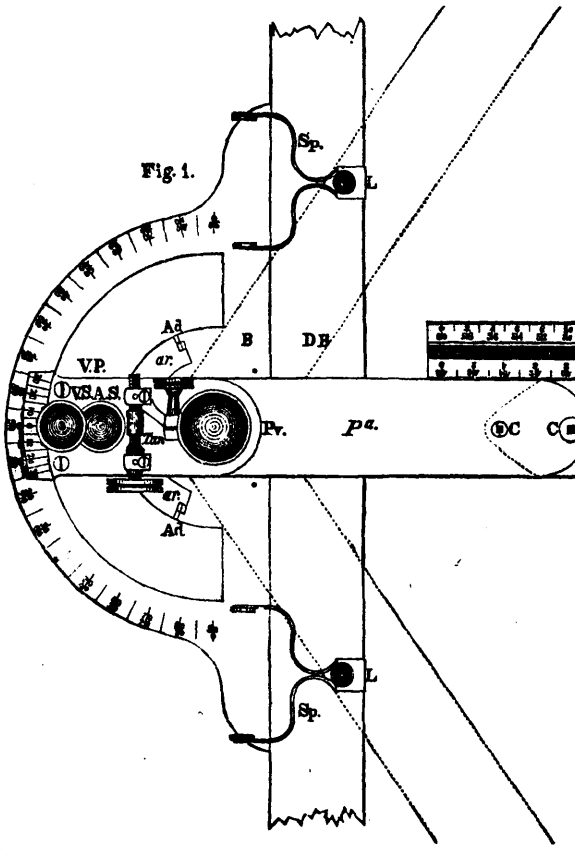
TO REMOVE TIGHT STOPPERS.—To remove glass stoppers when tightly fixed, it has been recommended to apply a cloth wet in hot water. This is an inconvenient and frequently unsuccessful method. The great object is to expand the neck of the bottle so as to loosen it on the stopper. If, however, the latter be heated and expanded equally with the former, the desired effect is not produced; and this is often the case in applying hot water. By holding the neck of the bottle about half an inch above the flame of a lamp or candle, for a few seconds, we have never failed in the most obstinate cases. The hands should be wrapped in a towel, and great care should be taken not to let the flame touch the glass, as this might cause it to crack. The bottle should be kept rapidly turning during the operation, so as to bring all parts of the neck equally under the influence of the heat, when it will be rapidly expanded, and the stopper may be withdrawn by a steady pull and twist. Following this plan, we have never failed once out of hundreds of attempts. When the bottle contains alcohol, benzine, ether, or similar inflammable liquids, great care must be taken lest the stopper should come out suddenly, and the contents of the bottle take fire.

IMITATION SHELL AND PEARL.— Imitations of lapis lazuli, tortoise shell and mother-of-pearl have been manufactured in Austria for more than 12 years. The "shell" imitation, which is in greatest demand, may be made on glass, and consists of a layer of clear gelatine, on which the characteristic markings of the tortoise shell are produced by dotting it with a concentrated solution of vesuvine (aniline color) to which a handsome reddish shade may be given with fuchsine; or the solution is spattered over the surface and the drops allowed to run together. When dry, the whole is covered over with a coating of glue. The imitation of mother-of-pearl is more difficult. It may likewise be made on glass, and contains in the first gelatine layer a concentrated solution of some salt. Several salts may be chosen for this purpose, such as white vitriol, epsom salts, &c. After the crystallization of this salt solution, and when dry, essence of pearls is spread over the whole. The latter material is made from the exceedingly fine and silvery-shining belly scales of the bleak, which are scraped off and washed out thoroughly. To the gelatine layer thus prepared, a coat of glue is applied and the article is then complete.

AN UNEXPECTED SCAVENGER.—An unexpected friend to man has been discovered in a kind of animacule engendered by sewage, which prevents the decomposing matter from becoming a dangerous nuisance. Mr. Angell, the public analyist for Hampshire, having examined the sewage-polluted fluid in Southampton water, has discovered that where the suspended matters are thickest there is going on a silent destruction of the foul matters through the agency of millions of minute creatures, by some held to be of animal, but Mr. Angell believed to be of vegetable origin. On examining the muddy fluid through a microscope it was found to contain myriads of little brown organisms surrounded with a gelatinous substance. Each specimen was found to be active in its movements and of peculiar shape, being furnished with a belt of cilia round the center of the body, and with a long, transparent, and very flexible tail. After death these tiny atoms give off an odor similar to that of sea-weed, and change to a green color. During life they evolve bubbles of oxygen gas, which serve to purify the water from the effects of the decomposing matter on which they themselves feed. It is a pity, however, that man, by polluting rivers with sewage, should stand so much in need of this self-developed scavenger.

EXPLOSION OF SAWDUST.—*A propos* the theory advanced on flour mill explosions, that all substances which are inflammable are also explosive, when finely divided in the shape of dust and mingled in the air, we notice that a gentleman of Appleton, Wis., has had an experience which verifies our theory. In his spoke mill, the upper story was used as a finishing-room, where the spoke was finished and polished by contact with rapidly revolving sanded belts. In this store was a stove for warming purposes. The fine, light dust produced by the operation of the belts upon the spokes, accumulated in every crack and crevice of the room, requiring to be cleaned off every day. One day, not long ago, some of this dust was seen to fall from a rafter upon some live coals that had accidentally been left upon the hearth. Instantly there was a flash that filled the whole loft, and set it on fire in a hundred places. It was with difficulty that the fire was subdued, and not without considerable damage to the building. We may also notice in this connection, that some scientific authorities in Great Britain assign the explosions in the coal mines there to clouds of coal dust instead of to fire-damp.

CALCULATING MACHINES.—In his address on the science of mathematics, Mr. Spottiswood made allusion to calculating machines. The idea of substituting mechanical for intellectual power has not laid long dormant, for, besides the arithmetical machines whose name is legion, from Napier's bones to Earl Stanhope's calculator, and the Schultz and Thomas machines, now in actual use, Prof. James Thompson has recently constructed a machine which, by means of the mere friction of a disk, a cylinder and a ball is capable of effecting a variety of complicated calculations which occur in the highest application of mathematics to physical problems. By its aid an unskilled laborer may perform the work of ten skilled arithmeticians. The machine is applicable alike to the calculation of tidal, of magnetic, of meteorological, and perhaps also of all other periodic phenomena. It will solve the different equations of the second and perhaps of even higher orders, and through the same invention the problem of finding the free motions of any number of mutually attractive particles, unrestricted by any of the approximate suppositions required in the treatment of the lunar and planetary theories, is reduced to the simple process of turning a handle.



The better class of instruments are provided with a vernier plate capable of being shifted to right of left 45° or less, and there clamped during any given operation. This arrangement, however, is applied only to that class of the instruments which is furnished with a tangent fixture for nice motion. But the same facility is practically secured to the other class by means of the steel bar just described.

A sliding square, either or whose arms (ordinarily of 5 and 6 inches in length respectively) may be held in contact with either edge of the protractor arm.

LYMAN'S TRIGONOMETER.

There is a wide contrast between the accuracy of engineers' field instruments and the draughting instruments used in the office. It is when the field notes are brought to the office, the engineer's troubles begin. His drawing boards warp: his rulers bend, or have no parallel edges; his rolling parallel rulers wear their wheels unequally; his T-squares are never square; his glass triangles will not prove four times round a circle; his paper protractor is badly divided, or shrinks in one direction and is awkward to use; his horn, brass or ivory semi-circles are wretchedly manufactured; his protractor makes holes in his paper, and is always in the way, and, if taken up, cannot be put down again true to the meridian; his scales are difficult to read and subdivide by the eye, stick to the paper, or slip too easily over it; and his prick point makes oval holes instead of circular ones, and not exactly at the division line of his scale.

Working under these disadvantages, it is no wonder that the engineer at his office table loses the keen zest for accuracy which characterizes him in the field. His lines are all more or less forced to a conclusion, and he feels but little disposition to carry his topographical work a single rod beyond compulsion.

To remedy these defects, Professor Josiah Lyman, of Lenox, Mass., many years since gave his study and experiment to protractors and scales. This resulted in the invention of the trigonometer shown in the accompanying engraving. It is an ingenious and strictly scientific combination, uniting in one machine the protractor, base bar, sliding square or T, and sliding scale.

The original instrument has been improved so that the under surface, including base and arm, is brought into the same plane with the draughting board or paper upon it, thus enabling the draughtsman to lay it flat upon any part thereof.

A steel bar is arranged so that it may be instantly clamped upon either the side or end borders of the board, or at right angles (at any point) across the board, or diagonally at any required angle across any one of its corners, upon which the trigonometer slides and to which it is held by spring force.

Triangular or tri-leaved scales may be used in connection with this instrument, being clamped by means of the spring S *p*.

The protractor plate B, which constitutes the base of the trigonometer, is made of German silver or hard brass silver plated, about the twelfth of an inch thick, having a face usually 10 inches in length.

At an inch or a little less back from the face is inserted the pivot P *v*, on which turns to right or left the arm of steel in two parts, namely, the attached part *p a*, and the arm proper P A. To the former is clamped the vernier plate V P. This terminates in an arc *u r*, of German silver, embracing about 135°, on whose limb are graduated two test marks A *d*, A *d*, and corresponding with these two similar ones on the base plate underneath. By these the protractor plate is adjusted for clamping. The two parts of the arm are fastened together by the connecting screws, C C, sufficient space between the arm proper and the protractor face being given to allow the instrument to play freely along the draughting or base bar D B, at an angle of 55° or less. The arm proper is therefore readily detached from the other part, thus allowing another of different length to be readily attached in its stead.

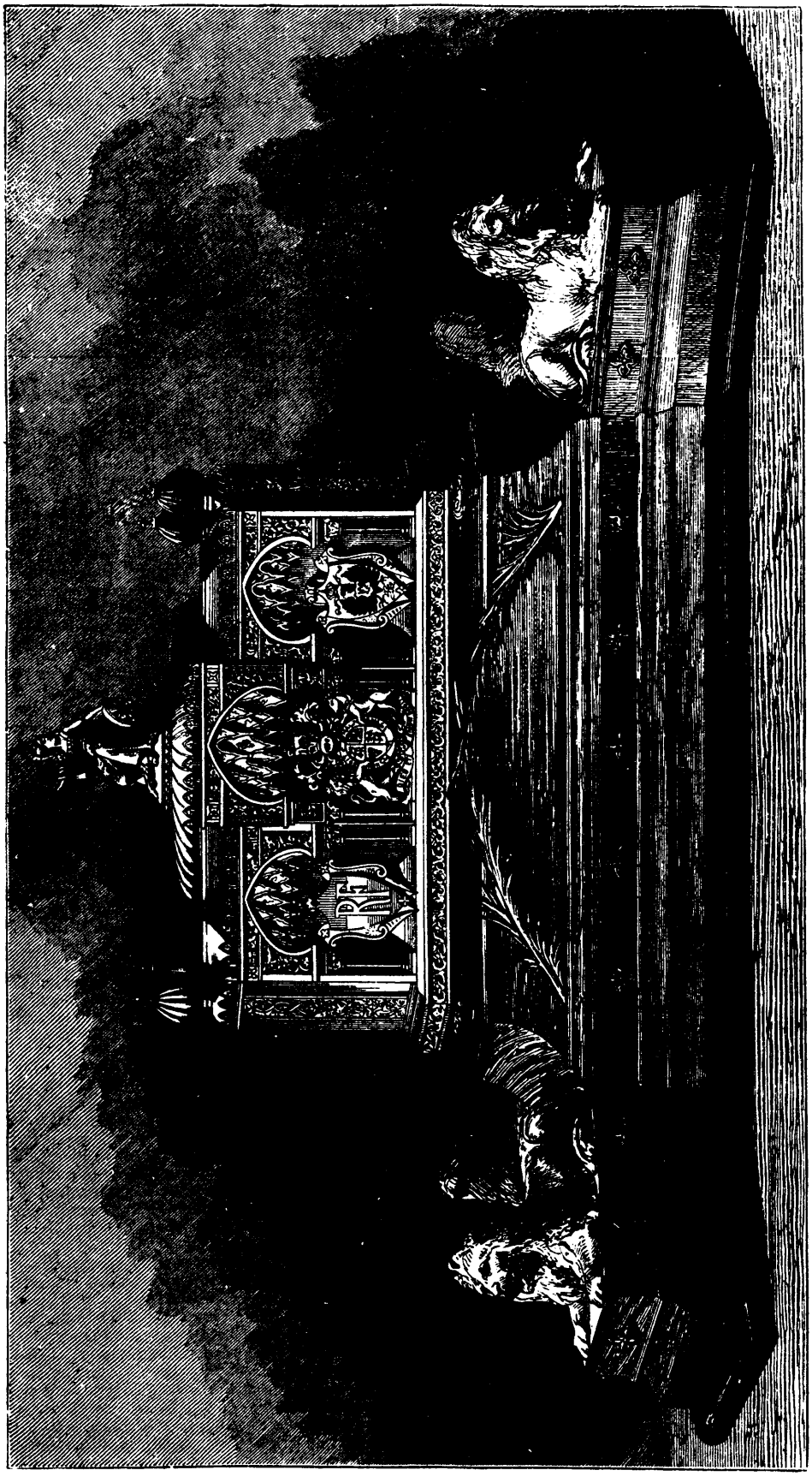
On the limb of the protractor plate (graduated to half degrees, reading directly to minutes, or indirectly and reliably to half minutes) are two readings, the inner, giving the angle of the arm with reference, to its meridian or zero line; and the outer, which gives the angle with reference to the protractor face. Hence every position of the arm indicates both the direct angle and the complement of the same. Therefore, in laying down the direct angle, the protractor arm only is required for guiding and operating the sliding scale; but in laying down the complementary angle, the sliding square is necessary; and this answers all the purposes of rectangular borders to the board.

This instrument may be applied to all problems for obtaining the varied lines and angles in architecture, or the construction of bridges or other similar works, with the sizes, forms, and position of all timbers, blocks of wood, stone or iron connected therewith.

For the use of engineers in cross sectioning excavations of earth or rock, for railroads or canals, or any other similar work, it is convenient and expeditious. The same is true of its application to military fortifications, as well as in the construction of machinery in the navy yards or other public works. When known by mariners, it will often supersede the use of the tables in their daily labors.

It is also applicable to the mensuration of heights and distances, and especially to the projection of eclipses and other calculations connected with astronomy.

With the greatest facility and accuracy, therefore, may any desired operation of triangulation be effected or trigonometrical problems solved by the use of this instrument. It renders unnecessary in all cases traverse tables, and for most purposes even logarithms, saving in all ordinary trigonometrical calculations half to three-fourths of the time and labor. With equal facility outlines of lots or tracts of land or other irregular figures may be plotted. Another very essential use of the trigonometer is in the division or laying out of lands. For further information address Professor Lyman, as above.—*Scientific American.*



GOLD CASKET IN WHICH THE FREEDOM OF THE CITY OF LONDON WAS PRESENTED TO LORD BEACONSFIELD

WORKSHOP MANAGEMENT.

Frederick Smith, an Englishman, has written a book on this subject in which he makes the following among other points, as described in a review. Not every one who owns or has charge of a workshop knows, or cares to know, upon what principles it should be conducted in order that success may accrue. Indeed, we do not hesitate to say that the incompetents are largely in the majority. Too often proprietors, so that they get an income which means a handsome interest on capital invested, an easy life, and some dignity, do not trouble themselves to inquire closely how the details of their business are being carried out; and as a result petty tyranny often flourishes, and frequently dissimulation and dishonest practices grow apace. The teaching that employers owe to their work-people the duty of watching their condition is not sufficiently recognized, and the consequences are found in diffidence and contensions. Now, to ignore this duty is unwise as well as improper, for where the employer evinces little or no interest in his people—is rarely seen by them, and more rarely heard as counselor—the belief forces itself that there exists indifference and selfishness, and corresponding qualities spring up on the other side. Demoralization is then rapid. "Give the least you can for the most you can get" becomes a guiding principle. What follows is depreciation of profits, and where drastic remedies are not applied crippling embarrassment often rears its head. If employers, then, desire the maximum of benefit from their business, among other things their knowledge of their workshops should be intimate and their interest in the laborers in them active. To the advocacy of this, much of Mr. Smith's book is devoted. But the author also finds ample opportunity for scathing condemnation of unworthy foremen, who connive at dishonest practices, and, by showing they have no self-respect, set the example of impropriety to those whom they are entrusted with the care and guidance of. The capable foreman and his qualities are, of course, likewise considered. He should be honest, honorable, respecting and respected, with his conscience ever for his guide, and intelligent enough to exercise his brains when difficulties present. Of course there are very few such; but only such are fitted for the position; and an employer who lacks the foresight enabling him to detect such qualities is minus a power he can ill spare.

CONTAGION IN CARPETS.

Sewerage in these days is receiving a fair share of public and private attention, and the walls of houses, where contagious diseases have been, are very generally cleaned, whitewashed, or newly papered; but carpets are too often overlooked as the carriers of disease. The truth is that they, more than any article of furniture, more even than the walls of the room, gather and retain dust; and this dust, though chiefly inorganic and comparatively harmless, contains organic germs, which only need to be raised into the air and taken into the human economy to develop into active disease, creating, under favourable circumstances, an epidemic. Dust usually considered as comparatively harmless, is a most fruitful source of catarrh and consumption. The irritation of the mucous membrane of the nose, throat and lungs, becoming chronic, leads to serious disease, that undermines health and destroys life.

Many women say: "If it were not for the sweeping of my carpets I could get along with housekeeping very well." Many women know from experience that sweeping is one of the great trials of the housekeeper's life, and that it causes much of "the weakness" among women. "Fore-warned is to be fore-armed." When we see the need of change, we are ready to accept the better methods. What shall these better methods be in relation to carpets and disease?

How easy carpets may convey contagion was proved by a case quoted by Prof. Tyndall, when he showed that a case of scarlatina, which was supposed by the physicians to be sporadic, was not so, but obtained by contagion. He said: "The question arose, How did the young lady catch scarlatina? She had come on a visit two months previously, and it was only after she had been a month in the house that she was taken ill. The housekeeper at once cleared up the mystery. The young lady, on her arrival, had expressed a wish to occupy a nice isolated room. In this room six months previously a visitor had been confined with an attack of scarlatina. The room had been swept and whitewashed, but the carpets had been permitted to remain."

THE electric light is about to be tried on the Copenhagen forts, and will light up a large part of the Sound.

THE King of the Belgians has been to the electro-metallurgic works of Haeren to see the statue of his late mother, Queen Louise-Marie, which is to be erected in one of the principal squares of Phillipeville. The monument is about eleven feet high, and represents the Queen seated, plucking the leaves of flowers.

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

DUST EXPLOSIONS.—Says the *Northwestern Lumberman*:—"Wherever there are liable to be accumulations of fine dust there is danger of an explosion; and it must be admitted that in wood-working factories, and particularly those converting dry material, it is rare indeed that dust is not found in abundance. It is true there have been few if any fires in wood-working factories traced directly to this cause; but it will not do to argue from this that none have occurred. A large proportion of the fires in planing-mills and similar institutions, are of unknown or accidental origin, and it is far from unreasonable to suppose that many of them would be found, if it were possible to investigate the matter, to have been the result of explosions of this character. There are many ways in which the necessary combination of dust and air might be effected, and the fire to ignite it supplied, while the chances of discovering just how it was done after the mill is destroyed are very small indeed."

DURABILITY OF ZINC ROOFS.—As zinc is an easily oxidizable metal, it has been suspected that it could not last long for a roof; but the fact is that the film of oxide soon formed over its surface is quite a protective coating, effectually preventing further oxidation. The film is water-proof and firmly adhering, and this is the cause of its protective capacity. Zinc differs in this respect very much from iron, of which the coating of oxid formed by exposure to moist air, is very porous and has not the adhesive quality, so that it is easily shaken off partially, while the moisture and air penetrating under it find a stronger hold, and eat, as it were, into the metal still more at every place where a rust spot covers it. Observation and experiments with exposed zinc have proved the extreme slowness of its oxidation, and the German *Zeitschrift für Gewerbe* reports that the data verified led to the deduction that a sheet of zinc one-50th of an inch thick would occupy 1,243 years in complete oxidation. A weight of 130 grains of zinc spread over the surface of a square foot would make a layer only one-5000th of a line thick. If the sheet be 0.25 line thick, there will be 46.04 such layers; and this, multiplied by 27, gives 1243, the total number of years.—*Manuf. and Builder.*

CELLARS.—There are hundreds of houses in the country that are built over dark, noisome holes full of dampness, impure air, decaying vegetables, and rotting timbers. The holes in the ground are called cellars, but they are so unsuited for the purpose which they are designed to serve, that they deserve rather to be called "death-traps." Light is as essential to the healthfulness and purity of a cellar as it is to the dining-room or parlour. The requisites of a good cellar are freedom from dampness, light, and a temperature low enough to prevent decay, and there is no difficulty in securing these conditions if cellars are only constructed above ground. Dark, close houses are notoriously unhealthy, and every possible device is resorted to to light and admit air-currents in them; yet we see cellars that are a hundred times worse than the darkest of houses left without light or ventilation, to breed germs of disease and death. All houses require cellars, both for the storing room they afford and their contribution to the comfort and health of the dwellers; but there is no reason why sanitary law should be set at defiance in their construction, neither is there any necessity for groping about in darkness, and, besides, when light is admitted there is an immunity from the danger of fire which attends carrying a light into the darkness, and which, from accident or carelessness, results sometimes in a disastrous fire.

MISCELLANEOUS ITEMS.

It is proposed to hold an industrial exhibition at Glasgow in 1880.

The Silicate Paint Company, of London and Liverpool, have been awarded a medal for their paints, which also obtained most favourable notice at the Paris Hygienic Congress.

The Town Council of Ayr have resolved to expend £10 in a series of experiments in lighting the town with electricity, the council to supply the motive power from a steam engine at present stationed at the head of the harbour.

Load for a Man.—A curious set of experiments made in France developed some interesting facts in regard to the greatest average load for a man of great strength to carry a short distance. This was found to be 319 pounds; all a man can carry habitually, as, for example, a soldier his knapsack, walking on level ground, is 132 pounds, (an extreme load it would seem,) or he can carry an aggregate of 1,518 pounds over 3,200 feet as a day's work, under like circumstances. If he ascend ladders or stairs, as do hod-carriers, then he can carry but 121 pounds continuously, and his day's work cannot exceed 1,232 pounds raised 3,300 feet high. With regard to the effort and the velocity with which a man can produce by pulling or pushing with his arms, it has been found by these experiments that, under the most favorable circumstances, and for continuous work, an effect cannot be gained exceeding from 26.4 to 33 pounds raised from 1.8 to 1.2 feet per second, or about one-eighth horse-power.

Ancient Surveying.—Two documents of great interest to geometricians have been discovered among the contract tablets in the British Museum. Attached to two terra-cotta deeds of sale of estates near Babylon are neatly drawn plans of the property. One sale took place in the reign of Darius Hystaspes; one toward the end of that of Nebuchadnezzar. The latter deed relates to a plot about 8½ acres in area, bounded on the north side by the canal of the goddess Banituo. The names of the owners of all the adjacent lands are given, and the greatest care is taken in giving the dimensions of these plots of land. The whole is divided into three pairs of parallelograms, and check dimensions are taken to test the accuracy of the work. A semi-circular portion of the east side is most carefully measured, both radius and circumference being given. The value of these documents as bases by which to fix both the linear and area measures in use in Babylonia is very great.

Wire Tramway Worked by Water-Wheels.—The tramway connecting the town of Lausanne with its harbor Ouchy, on the lake of Geneva, consists of two lines of rail, and two trains which are connected by a wire rope. At the top of the tramway the rope passes over a winding drum, through which the trains are put in motion. The two trains keep each other in equilibrium, the one ascending upon one line while the other descends on the other line, and *vice versa*.

The tramway is 1650 yards long, and leads in a straight line from Ouchy up to Lausanne, passing on the way a tunnel several hundred yards in length. The steepest gradient is 1 in 9.

The winding drum is driven by two Girard turbines, which work under a head of 393 feet; they are made of brass on account of the high velocity of the water, due to the great head; they have a diameter of 7 feet 4 inches, and run at a speed of 170 revolutions per minute. The water can easily de turned on and off the turbines by means of circular slides worked by hydraulic gear.

The two turbines are fixed upon a horizontal shaft, which carries also a break wheel, the band of which is worked by gears similar to the slides, and spur gear for transmitting the motion to the winding drum.

The winding drum is 19 feet 8 inches in diameter, and 13 feet long, and is covered with wood lagging. As it has to transmit by mere friction a force 180 H.P., making at the same time only a few revolutions per minute, the following arrangement to produce the necessary friction has been contrived by M. Callon, the designer of the tramway: the winding-drum is placed in a position parallel to the direction of the tramway, and considerably lower than the level of the rails, ; the rope is wound on the drum in two coils, and above the drum; the two ends of the rope are made to pass over the guide-pulleys, which stand at right angles to the drum, and are carried in sliding bearings. By means of bevel gear and screw spindles these pulleys are made to move too and from along the winding drum, thus forcing the rope to travel continually from one end of the drum to the other, and preventing the surface of the latter from being worn smooth, as it would be if the coil were always on the same spot.

PLUMBAGO AS A MOLDERS' "FACING."

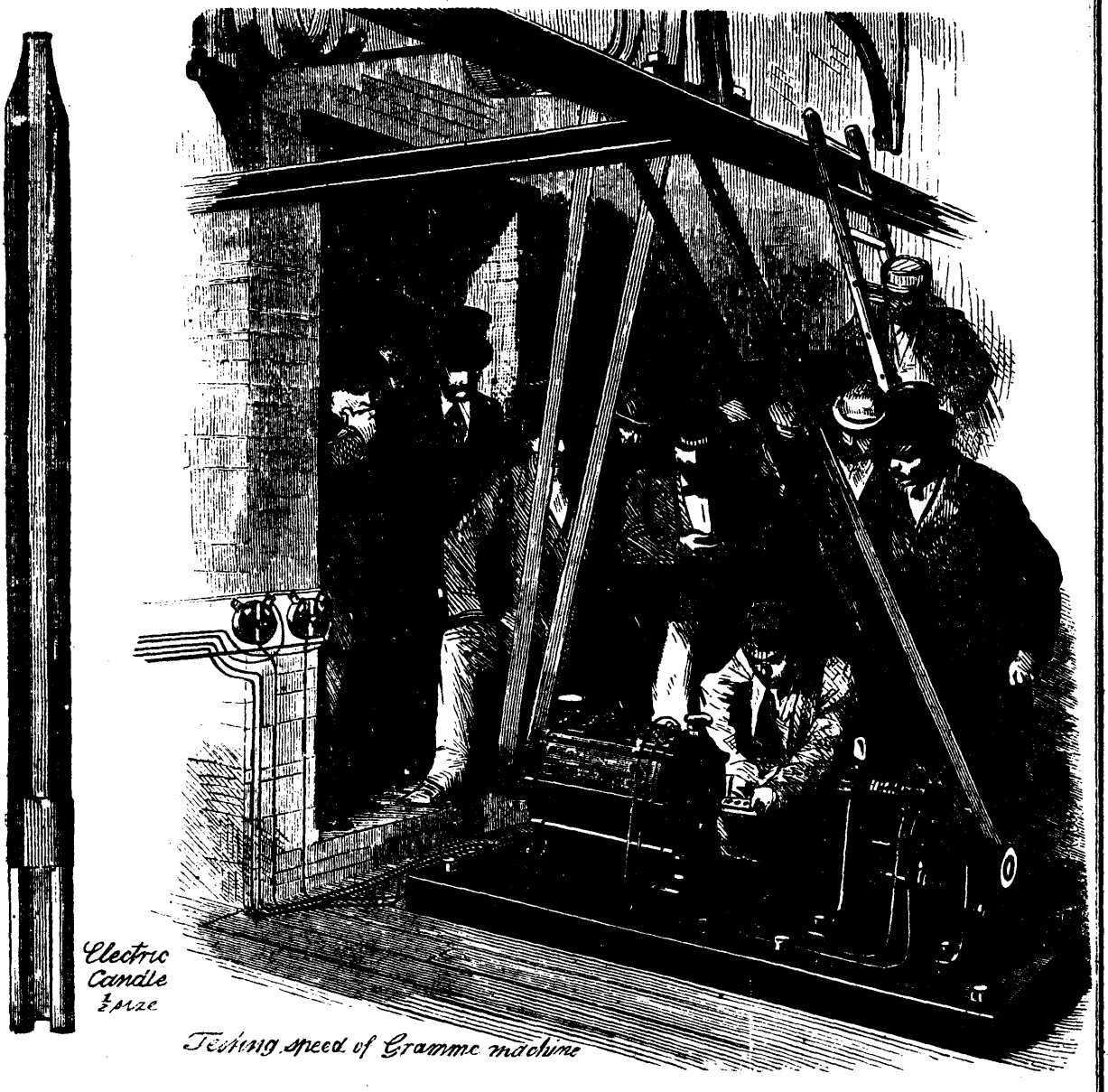
We notice that the use of plumbago as a facing in molders' castings is exciting the attention of European metal founders. Although this material has been used to a considerable extent in this country for some time, it will doubtless interest our foundrymen to read what their European contemporaries say of it. We quote from letters written to the *Ironmonger* of London.

A founder in Cadiz, Spain, writes as follows: Having for upwards of thirty years, been casting church bells for different parts of Spain, also a great many for the Philippine Islands, I also had a great difficulty in finding a wash sufficiently strong to avoid the silver and tin employed in the bell metal penetrating into the loam, and causing an immense deal of trouble in the cleaning of the bell. Last week I cast a large bell for the cathedral here, to which I applied plumbago powder as a wash, mixed with whiting and salt. The result was more than I anticipated, as on taking the bed out, the loam left it without even the trouble of touching it, but dropped off of its own accord. I have also applied it to the casting of heavy gun metal castings and cast iron pieces, and in all it gave good results.

An English founder writes: We have carefully tried the use of Plumbago, both in our iron and in our brass foundries—with a decided benefit in the sharpness and face of iron castings—that is by using plumbago for dusting the molds. Plumbago pure and simple, and the better the quality of the plumbago the better the result; but in brass (yellow metal) and pot-metal castings neither the pure plumbago nor mixtures of plumbago and meal-dust, or plumbago and tan (or wood) ash was so satisfactory as would warrant its use in that way, whilst for heavy gun metal casting pure plumbago gives a clean face and a fine skin. The use of plumbago for yellow or pot metals we have found to be the best by first dusting the molds with pea meal, and then on that a slight dust of plumbago. With this we get splendid castings, quite equal to any American, both as to sharpness and cleanliness, admirably suited for steam valves to be left in the rough on their bodies, and effecting a very great saving in trimming and finishing polished goods.

Improvement in Soldering Irons.—A novel soldering iron, the invention of M. Paquelin, was recently described before the Academy of Sciences, Paris. Its distinctive feature is a platinum receptacle, in which heat is instantaneously generated with air and petroleum vapor or air and coal-gas.

Note on "Blowing Off" Steam Boilers.—In a French essay on the care of steam boilers, we find a note on the advantage of cooling off the arch after stopping and before "blowing off." It is as follows: Those who possess externally-fired boilers working only by day have all observed that the fire being covered at night, and the doors closed, the pressure rises during the night, often sufficiently to open the valves. This shows that the masonry, being at a much higher temperature that the boiler which it envelopes, imparts to it some of its heat. The same effect of heating the boilers by the masonry is produced to a less degree, it is true, but, nevertheless, to some extent on the outer jacket of internally-fired boilers. It is consequently injurious to empty boilers soon after having stopped them, because after emptying, the plates would be heated by the action of the masonry. It is well to admit a current of air through the flue some hours after the stoppage of the generator, and not to empty it before the flues have become cooled to a temperature below 150°. When the flues are not too hot, no serious inconvenience is experienced in emptying the boiler under pressure. We do not say at high pressure, as for a boiler the pressure of which would be 5 kilogs., the temperature of the water being 152°, a great quantity of steam would be generated during the process of emptying; we think that at a pressure at 1 kilog. the boiler could very well be emptied. In internally-fired boilers, as there is no masonry to cool in the furnace tubes, it would be preferable to admit the current of air intended to cool the masonry behind the boiler, as in this case the furnaces would not be cooled more rapidly than the jacket. We have sometimes seen owners empty their boilers almost immediately after the fires have been extinguished, clean them with cold water as soon as they were empty, and keep up a current of water so that the workmen might work there. Boilers of small dimensions sometimes resist this treatment, but in large boilers it will be seen that unequal contractions must take place which burst the rivets.



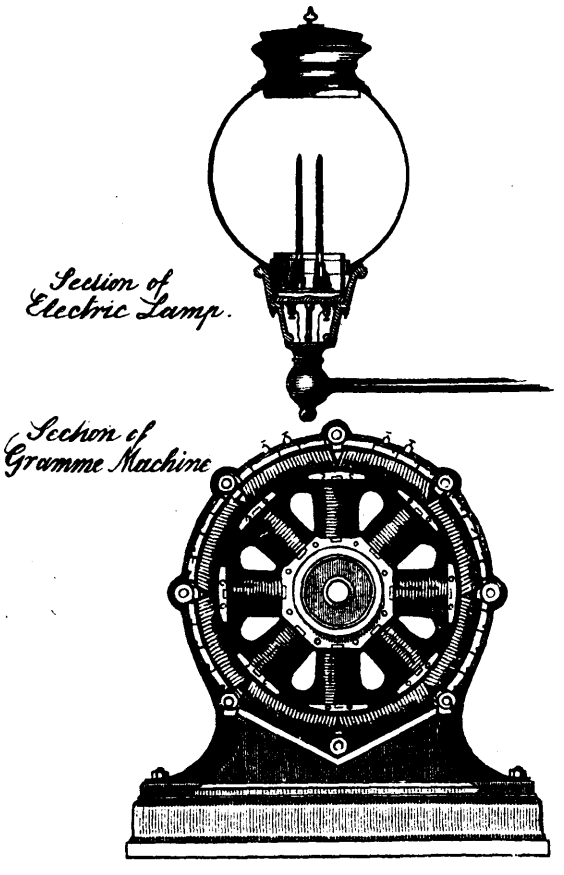
THE ELECTRIC LIGHT.—SKETCH OF THE APPARATUS.

THE ELECTRIC LIGHT.

The apparatus exhibited by Messrs. Wells & Co., of Shoreditch, for the production of electric light by the Jablochkoff process, is shown in the engraving, for which we are indebted to the London *Graphic*. It consists of a Gramme machine, a section of which is given to show the arrangement of magnets around a central axis. This rotates about 1,100 times per minute, and is driven by any ordinary engine. The Jablochkoff candle consists of two sticks of moulded carbon, embedded in a mass of composition to give them solidity, and are separated by a column of plaster of Paris, which acts as an insulator. The two carbons are connected at top by means of a thin stick of carbon one millimeter in diameter. The entire candle is held in a strong metal clip. Four of these are contained in a lamp, and are burnt in succession, an automatic arrangement shifting the current as each one is burnt out.

Messrs. Wells exhibited three of these lamps inside and one outside of their large show rooms, the illumination of which was perfect, showing colors distinctly, and, being diffused, did not cast heavy shadows. They afterwards burnt six candles on one stand, simultaneously producing a brilliant light and solid shadows. As to the light itself, there is but little difference, and that only to be noted by experts, between it and the light produced by the systems that have already been adopted in London. It is of a very powerful character, and it extends its illuminating influence for a considerable distance without much apparent diminution of strength.

M. Jablochkoff, the inventor of this form of the electric light, writing in reply to the question as to what distance from the source of electricity a luminous center may be produced, says that the distance may be as great as is wished,



THE ELECTRIC LIGHT.—SKETCH OF THE APPARATUS.

only it is necessary to employ a conductor of very great diameter in order not to increase the total resistance of the circuit. In reference to Mr. Edison's claim to have solved the question of the divisibility of the light, M. Jablochkoff writes that he long ago realized its divisibility, as is proved by communications from him to the Academy of Science and the French Physical Society, in December, 1877, and February, 1878. It has, moreover, he states, been shown in public at the Sorbonne, and has been in use at the Exhibition since the 1st of May. M. Jablochkoff says:

"In view of this fact, it may not be inadvisable to say a few words on the calculations which have been made as to the cost of the light. These calculations are of two orders. The opponents of the electric light represent it as costing very dear; its partisans, and, above all, its propagators, on the contrary, give figures which we may not, perhaps, call inexact, but which, nevertheless, are only theoretical figures, and, consequently, little capable of being justified by practice. To better understand my idea, I shall suppose the following calculations for my candle. The electric candle consumes per hour 77 grains of crayon, composed simply of coke and plaster; the ton of best coke costs $9.00, and the pound of plaster 8 cents. Taking these figures as a basis, we find that the consumption of my candle, representing 100 jets of gas, costs 0·0055 cent per hour, which gives a figure almost impossible to formulate. Multiplying by 1,000, we may say that an electric light replacing 10,000 jets of gas costs 5½ cents, while these 10,000 jets represent an expense of 84 cents per hour. No one could prove these figures inaccurate, and yet I should never dare to represent them as realizable in practice. As to the cost of the electric light, I shall only say this—wherever it has been employed there has been a very notable economy. In the Louvre, for example, where this light has been in use for a year, the proprietors of the magasins have proved a saving of 30 per cent, and with more light than with gas. I conclude by saying that progress in the cheapness of the light is clearly indicated. The electric candle, which is manufactured at this moment at the rate of from 3,000 to 5,000 per day, and in consumption costs 10 cents per hour, must necessarily become cheaper when we manufacture 50,000 per day; but to announce the future eventual result as an accomplished fact is to mislead the public." *Scientific American.*

STUDIO GLUE.—Every one knows what a nuisance it is to "heat the glue-pot" when some small mend has to be made. And most people also know that all substitutes for glue are more or less failures for wood-work of all kinds; and, indeed, for most kinds of soft substances there is no cement that is so thoroughly satisfactory as glue. I have found an exceedingly simple way of using glue for small mends, and for general purposes where but a little is wanted at a time. The simplicity of the matter is so great as almost to need an apology for mentioning it, but its utility is so great that I must make *that* my excuse for writing about it. This is the method:— Put a pinch of Nelson's shredded gelatine into a wide-mouthed bottle; put on it a very little water, and about one-fourth part of glacial acetic acid; put in a well-fitting cork. If the right quantity of water and acid be put, the gelatine will swell up into worm-like pieces, quite elastic, but, at the same time, firm enough to be handed comfortably. The acid will make the preparation "keep" indefinitely. When required for use, take a small fragment of the swelled gelatine, and warm the end of it in the flame of a match or candle; it will immediately "run" into a fine clear glue, which can be applied at once direct to the article to be mended. The thing is done in half a minute, and is, moreover, done well, for the gelatine so treated makes the very best and finest glue that can be had. I have no doubt this plan might be modified by dissolving a trace of chrome alum in the water used for moistening the gelatine, in which case, no doubt, the glue would become insoluble when set. I have not tried this, as, for general purposes, there is no need for subsequent insolubility in glue.

AMONG the most remarkable inventions represented at the recent paper exhibition at Berlin were paper teeth. They are said to be singularly durable.

THE *British Medical Journal* says that a site has been secured for a crematorium near London, by the Cremation Society of Great Britain; and Mr. Eassie, C. E., has been instructed to erect upon it a pyre of the kind designed by Gorini and now in use at Milan.

PRACTICAL RECIPES.

ARTIFICIAL BEESWAX. — A mixture of paraffine and common resin has found its way into the market as a substitute for beeswax. It resembles the genuine article very closely in color, fracture and adhesiveness. The cakes are generally covered with a thin coat of genuine beeswax.

POSTAGE-STAMP MUCILAGE.—The following is said to be the formula for the mucilage used on the United States postage-stamps: Dextrine, 2 oz.; acetic acid, 1 oz.; water, 5 oz.; alcohol, 1 oz. Add the alcohol to the other ingredients when the dextrine is completely dissolved.

STRAIGHTENING A WOODEN SHAFT.—Mr. D. A. Ammen, of Snowville, Va., sends the following: A wooden shaft can be straightened by taking hard seasoned wood and baking it in a stove or oven to get it to the smallest possible size. Dovetail it into the swagging side of the shaft, at the crookedest part. I straightened, perfectly, my bolt shaft, twenty-two feet long, in this manner, and have used it three years.

VARNISH FOR BASKET WARE.—The following varnish for Basket-work is said to dry rapidly, to possess sufficient elasticity and to be applicable with or without admixture of color: Heat 375 grains of good linseed-oil on a sand-bath until it becomes stringy, and a drop placed upon a cold, inclined surface does not run; then add gradually 7500 grains of copal-oil varnish, or any other copal varnish. As considerable effervescence takes place, a large vessel is necessary. The desired consistency is given to it, when cold, by addition of oil of turpentine.

JAPAN FOR IRON-WORK.— To make a japan for iron, mix shellac varnish with a sufficient quantity of ivory-black or lamp-black. Other methods are the following: (1.) Asphaltum, 1 lb.; melt, and then add hot balsam of copaiba, and thin with turpentine (2.) Grind lamp-black very smooth, and add copal varnish to the proper consistence. (3.) Asphaltum, 3 oz., boiled oil, 4 quarts; burnt umber, 8 oz.; mix by heat, and when cooling thin with turpentine. (4.) Amber, 12 oz.; asphaltum, 2 oz.; fuse by heat, and add boiled oil, ½ pint; resin, 2 oz.; when cooling add 1 pint of turpentine.

TO DRILL GLASS.—Glass can be drilled with a common drill very readily, by using a mixture of turpentine and camphor. When the point of the drill has come through, it should be taken out and the hole worked through with the point of a three-cornered file, having the edges ground sharp. Use the corners of the file, and scraping the glass, rather than use the file as a reamer. Great care must be taken not to crack the glass or flake off parts of it in finishing the hole after the point of the drill has come through. Use the mixture freely during the drilling and scraping. The above mixture will be found very useful in drilling hard cast-iron. Tempered steel can be drilled by making the drill very hard and using this mixture.

ANOTHER CURE FOR CORNS.—The safest, the most accessible, and the most efficient cure of a corn on the toe, is to double a piece of thick soft buckskin, cut a hole in it large enough to receive the corn, and bind it around the toe. If in addition to this, the foot is soaked in warm water for five or more minutes every morning and night, and a few drops of sweet or other oily substance are patiently rubbed in on the end after the soaking, the corn will almost infallibly become loose enough in a few days to be easily picked out with the finger nail; this saves the necessity of paring the corn, which operation has sometimes been followed with painful and dangerous symptoms. If the corn becomes inconvenient again, repeat the process at once.

SUPERIOR ADHESIVE PASTE.—Take 4 parts by weight of good glue, and cover it with 15 parts of cold water, allow it to stand for a few hours, and then gently heat until a clear solution results. Dilute the mixture with 65 parts by weight of boiling water under constant stirring. In the meantime prepare a paste of 30 parts by weight of starch and 20 parts of water, avoiding all lumps. Into this pour the boiling hot solution of glue, under constant stirring, and keep the mixture boiling. After it is cold, add ten drops of carbolic acid. This paste is unusually adhesive. It can be used on leather, paper, pasteboard, and parchment, and if it be kept in closed bottles, to prevent the evaporation of water, may be preserved for a long time. In cases where ordinary stock paste will answer every purpose, it is always well to add a few drops of carbolic acid to avoid fermentation or molding.

SCIENTIFIC ITEMS.

A PIECE of paper saturated in sugar of lead will be a test for sulph. hydrogen constituent of sewer gas.

THE TRAFFIC OF THE SUEZ CANAL for the first four months of 1878, as compared with the corresponding period of the two years preceding, was as follows:

Number of ships passed through January-April,	1878.....	620
" " " " "	1877.....	613
" " " " "	1876.....	576
Transit revenue collected 4 months,	1878.....	£464,876
" " " "	1877.....	486,388
" " " "	1876.....	451,200

A BONY RIVER.—In Dublin there is a warehouse of a bone mill which contains several thousand tons of fossils of the Jurassic period—teeth, vertebræ, fibula, jaws and limb bones, which are thrown indiscriminately into the mill, which is of enormous power, to crush the harder than flint petrified bones. These are dredged up from the river Bull, in North Carolina, the largest deposit of fossil remains ever discovered. For forty miles the river runs through petrified bones. They are first loosened by enormous crowbars worked on the principle of pile drivers, and then dredged up. This river yields several hundred thousand tons of fossil bones each year.

MAKING PENCIL-MARKS INDELIBLE.—Paper marks are made indelible, says the *Papier Zeitung*, on paper prepared as follows: Any ordinary drawing-paper is slightly warmed and then rapidly and carefully laid on the surface of a bath, consisting of a warmed solution of bleached colophonium in alcohol until the entire surface is moistened. It is then dried in a current of hot air. The surface of the paper becomes smooth, but readily takes the impression of a lead-pencil. In order to make the lead-pencil marks indelible, the paper is warmed for a short time on a stove. This method may prove valuable for the preservation of working drawings when a lack of time will not permit the draftsman to finish them in ink.

BURNING GREEN PEAT UNDER BOILERS.—The Montague Paper Company, Turner's Falls, have been burning green peat successfully, under their boilers set with the Jarvis patent furnaces, but as soon as the owners of peat bogs in that vicinity found it could be burned successfully without drying, they raised the price so high that the mill has gone back to screenings again. Peat land in the New England States is not worth, on the average, over $5 per acre. It costs about 50 cents per cord to dig and haul peat when within a mile of the mill. Three cords of green peat, burned by the Jarvis process, are equal to one ton of the best soft coal, and the economy over anthracite coal is from 30 to 40 per cent. Every mill having peat lands near at hand can supply their own fuel at small expense, as the peat is not dried, but used as dug, with a little soft coal mixed.

MR. BOWER'S process of protecting iron from rust by coating it with a film of magnetic oxide has been tried at Dudley, and has proved to be so satisfactory that it is believed that henceforth iron structures may be regarded as practically indestructible. Professor Barff's process, it will be remembered, consists in subjecting the iron to the influence of superheated steam, but there are obvious difficulties in its application. In Mr. Bower's process it is necessary only to heat the iron to a certain temperature in a closed chamber, so as to admit air at intervals. The difficulties attending the use of superheated steam are therefore avoided, and as the expense is comparatively small there is reason to hope that at last we are in a position to settle the rust question, and iron will become *par excellence* the representative metal of civilization.

KEEPING ON THE SCALE.—The Royal Laboratory Department in the Royal Arsenal, Woolwich, have practically abolished the operation of giving a smooth surface to shot and shell by the use of the lathe. The method of casting these projectiles of exact size and smooth exterior was first carried out on account of the expense which would be saved by the abolition of turning, but a still greater advantage has been found in the superior hardness of the unturned shells, the one-tenth of an inch of the outer skin which it has been usual to turn off the Palliser projectiles being equal in strength to one-third of the interior surface. By reducing the thickness of the walls the shell is thus enabled to contain a much larger bursting charge without any diminution of penetrative power, and the whole mass proves to be more cohesive and serviceable in what may be regarded as its natural skin, than after the material and chemical changes wrought in its constitution by the friction of the lathe.

HOW TO TEST A LATHE.

To test if the cone spindle is parallel with the ways or shears, bore a long hole in a piece of cast iron, using a stout tool holder, and a short stiff tool, taking a fine cut with a tool having its cutting edge slightly rounded, with a feed of 16 to an inch, at a speed of 25 ft. per minute. Let the tool feed through the hole and back again, so that it may be definitely known that the tool does not spring away from the work. Then, without moving the tool from the cut, wind the tool to the entrance of the hole, and let it stand there while the lathe runs forty or fifty revolutions. Traverse the tool to the other end of the hole, and let it stand while the lathe runs again. Then stop the lathe and traverse the tool (without taking it from the cut) along the hole, and if it marks a line stronger at one end of the hole than at the other, the tool has sprung and another fine cut must be taken as before, but if not and the whole is parallel, the spindle is true.

To avoid the wear of the tool it must be made as hard as possible. If the cut was started at the front and the hole bored is smallest at the back, another cut should be taken, commencing at the back and feeding toward the front. If the hole is still smallest at the back, the lathe cone spindle is not parallel with the ways.

To determine whether the cross slide is at a right angle with the ways or shears, take a fine cut over a radial face, such, for example, as the largest face plate, and test the finished plate with a straight edge. If the face plate runs true and shows true with a straight edge, so that it is unnecessary to take a cut over it, grind a piece of steel a little rounding on its end, and fasten it in the tool post or clamp, with the rounded end next to the face plate. Let the rounded end be about ¼ inch away from the face plate, and then put the feed motion into gear, and, with the steel near the periphery of the face plate, let the carriage feed up until the rounded steel end will just grip a piece of thin paper against the face plate tight enough to cause a slight strain in pulling the paper out, then wind the tool in toward the lathe centre and try the friction of the paper there ; if equal, the cross slide is true.

In taking a cut down a radial face, to test the truth of the cross slide of the rest, the cut should be started from the periphery, for the following reasons : It is obvious that to some degree (however slight it may, under careful manipulation, be) the tool will become dulled as the cut proceeds. Now with an equal depth of cut, and under equal conditions, there is more strain and wear upon the tool edge when cutting the larger than when cutting the smaller diameter.

To test the workmanship of the back head or tailstock, place the forefinger on the spindle close to the hub whence it emerges, and observe how much the hand wheel can be moved without moving the spindle ; this will show how much, if any, lost motion there is between the screw and the nut in the spindle. Next wind the back spindle as far as it will go, take hold of the dead center and pull it back and forth, when an imperfect fit between the spindle and the hole in which it slides will be shown by the lateral motion of the dead center. Wind the dead center in again, and tighten and loosen the spindle clamp, and see if doing so moves the spindle in the socket. Wind the dead center out again and slide the tailstock up the lathe bed until the dead center nearly touches the live one, and after bolting the tailstock to the lathe bed, bring the center points close together and see if they coincide. If the tailstock sets over for turning tapers, the setting screws may be operated to adjust the centers.

To examine the slide rest, move the screw handles back and forth to find how much they may be moved without giving motion to the slides ; this will determine the amount of lost motion between the collars of the screws and between the screws themselves and the nuts in which they operate. To try the fit of the movable slides in the stationary sliding ways or Vs, remove the screws and move the slide so that only about one-half inch is in contact with the Vs, then move the slide back and forth laterally to see if there is any play. Move the slide to the other end of the Vs, and make a similar test, adjusting the slide to take up any play at either end. Then clean the bearing surfaces and move the slide back and forth on the Vs, and the marks will show the fit, while the power required to move the slide will show the parellelism of the Vs.

If the lathe carriage has a rack feed, operate it slowly by hand, to ascertain if it can be fed slowly and regularly by hand, which is of great importance. Then put the automatic feed in gear, and operate the feed gear back and forth, to determine how much it can be moved without moving the slide rest. To test the fit of the feed screw to the feed nut, put the latter in gear and operate the rack motion back and forth. It has been assumed in this method of testing that means of adjustment are provided whereby any play in the cone spindle bearings may be taken up.

HOW TO USE A FILE.

By Joshua Rose, M.E.

The excellence of a piece of work operated upon by a file is only limited by the skilfulness of the operator, because a file can be made of any required form and size, and the quantity of metal it will cut away and the location of the same may be varied at will ; hence it is evident that it is possible to perform with the file every cutting operation assignable to steel tools.

The legitimate use of the file may be classed under four headings :—1. The removal of surplus metal. 2. To correct errors in the truth of work that has been operated upon by such machine tools as the planer and shaper. 3. The production of small intricate or irregular forms. 4. To fit work together more accurately than can be done by the use of other tools. With reference to the first, the domain of the file has of late years been greatly circumscribed by the introduction of special machines which will finish small work sufficiently accurate to render subsequent filing unnecessary. As a correcting process, however, filing still maintains a pre-eminent position from the fact that no other tool can be so delicately or minutely applied, and it is found that work produced by special or other machine tools, though sufficiently true for ordinary purposes, yet require correction in all cases where the utmost attainable exactitude and smoothness are required. One of the main reasons for this is to be found in the fact that work to be operated upon in special machines requires to be held or clamped firmly, and as a result is almost inevitably sprung. Another reason is that in filing, the work, unclamped and therefore unsprung, may be tried to its place or to gauge, &c., and any detectable error remedied. On large work this is especially the case, and for this reason the file is almost the only finishing tool. In the production of small intricate, or irregular forms, the file is either used to originate a cutter or tool to be used in a machine tool, or if but few of the pieces are required, it is applied direct to get out the work, machine tools being employed to rough the work out somewhat near to the required shape.

It is always desirable that the surface to be filed should lie horizontally level, and for ordinary work the face to be filed should be about the same height as the operator's elbow. If the work is large and requires a long reach, it is better to be lower, while if it is very small, so that but little pressure is required upon the file, it may be placed higher, so as to render less stooping necessary, and the eye may be able to add its scrutiny to the sense of feeling of the hand, upon which principally successful practice depends. When the work is level with the elbow, the first joint of the arm is in a line with the force required to push the file, which places less strain upon the arm. This is of great consequence in filing chipped surfaces or removing a quantity of metal.

The teeth of a file are unequal in height, and as the file warps in hardening, it is evident that, even supposing the operator to move the file in a straight line, the surface filed would not be straight ; hence files to be used upon flat surfaces should be thickest in the middle, and thinner at each end of their lengths. This gives to the surface of the teeth tops a curve or sweep in the length of the file, so that if it should warp slightly in the hardening process, the effect is to merely lessen the sweep on one side and increase it on the other. This is of but little consequence, because by altering the height of the respective ends of the file to the work, any part of the file may be brought into contact with the work, and its action located to any required part of the work. If the file is moved in a straight line it will file flat so long as the surface is curved ; but if the file is hollow in its length, it cannot under any circumstances file a flat surface, and one of the greatest objections to recut files is that the original curve is not maintained. The most expert mechanic, however, cannot move a file in a straight line, and the curve of the file is usually about sufficient to compensate for the variation of the stroke from a horizontal plane. The level of the teeth across the file may either be flat or slightly rounding, but in no case should it be hollow, for in that case the two file edges would cut two grooves.

For convex surfaces a flat file is usually employed, but for concave surfaces the file must be given a convexity greater than the concavity of the work, so that any desired part of the file may be brought into contact with the work, nothwithstanding a slight irregularity in the curve of the file. A round file should always be a trifle smaller in diameter than the hole it is to be used upon, and before inserting it in the hole the eye should be cast along the length of the file while the latter is revolved slowly in the fingers. By this means we may select the curve in the length of the file, and bring it to bear upon the work so as to avoid filing the edges away.

[*Continued on page 376.*]

BRONZE STATUE OF CAPTAIN COOK, FOR SYDNEY, AUSTRALIA.

STATUE OF CAPTAIN COOK.

The committee who have made the arrangements for the bronze statue of Captain James Cook, the great navigator, which is to stand on a lofty pedestal, 22 feet in height, overlooking Sydney Harbor, have given their sanction to the statue being exhibited for two months in London before it is shipped for New South Wales, and the colossal figure has been accordingly placed on the same squuare of land, between the Athenæum and the Senior United Service Club, on which the late Mr. Foley's equestrian statue of Sir James Outram, now in Calcutta, was diplayed for a time for the criticism and admiration of London. The custom of preliminary exhibition in London has many advantages, and might well be made general. Mr. Woolner, R.A., is the sculptor of the fine piece of statuary which is now to be seen at the foot of Waterloo Place. He has chosen the moment when the intrepid sailor has just sighted the land of New Holland, which he called New South Wales and took possession of in the name of the King. As we know from the narrative of his famous voyages, this was at an early hour on the morning of the 19th of April, 1770—108 years ago. The founder of the Australian colonies is represented with his right hand thrown in the air in a gesture expressing exultation: his left hand holds the telescope with which he has just seen the dim loom of the land. He wears, of course, the naval costume of the last century, and there was no difficulty in procuring an accurate likeness of him to serve as the original of the manly and intelligent face, which in the statue is thrown back as the eyes seem to scan the horizon. The Royal Society struck a medal in commemoration of Captain Cook after his tragic death at Hawaii; there is a fine Wedgwood medallion of him extant by Flaxman, and Nathaniel Dance painted his portrait. It hangs not far from the relics of Nelson in the Painted Hall of Greenwith Hospital. The back of the figure will be scrutinized by those who are interested in the old naval pigtail, which was the head ornament of all the best known maritime heroes of English history. The monument is 14 feet in height. It is at present placed on a wooden pedestal 13 feet high, and the effect is, therefore, not quite the same as it will have on the much loftier pedestal for which it is destined at Sydney. It was the work of three years, and has been cast by Messrs. Cox & Sons, who have recently sent fine statues to Glasgow. The weight of the statue is about two tons. Mr. Woolner's hand is already known in the Southern hemisphere by his statue of J. R. Godley, the founder of the Canterbury settlement, which is placed in Christ Church, New Zealand. To have executed for Sydney the statue of Captain James Cook, which after thirty years' discussion the colony is at length on the point of possessing, is to have a surer title to immortality. We take our illustration from the London *News*.

WHAT IS GOLD?

A recent action at the Thorne County Court throws an odd light on the laxity of definition with which the precious metals are afflicted in this country.

A man named Whitehead, of Thorne, sued a jeweler named Gordon, living at Grimsby, for three guineas, the value of a chain sold by the defendant as "gold," but which plaintiff contended was not gold, and was not what was sold by jewelers as gold. Plaintiff produced a witness who swore that the Albert did not contain more than one part of gold to ninety-nine parts of copper, and he said that the utmost value of the chain would not be more than 10s. He admitted that on the swivel there was a mark giving the proportion of gold as nine carats, but he said that this mark only applied to the swivel, and not to the whole chain. Defendant admitted that he sold the chain as gold, having bought it as a gold one from a Birmingham manufacturing jeweler! As a proof of what he said, he offered to allow the chain to be sent to any assayer, and promised, if it was not gold, to return plaintiff his money and pay expenses.

The assayer will, we take it, be puzzled; for the gold of commerce is of no regulation strength and fineness. Twenty-two carat gold is more talked about than used for jewelry, and eighteen and sixteen carat are far more generally employed. For gold chains very common qualities are used, and it is difficult to say at what point the degradation of the precious metal ceases.

If we are not mistaken, the chain now *sub judice* is, in quality, akin to the metal known in the trade as "jewelers' gold." We are not certain of the proportion of gold and alloy in this precious product, but rumour says that to every golden sovereign a copper coal scuttle is added.

HORSE-SHOE NAILS.

One of the most prominent of all causes of lameness in horses is the slivering of poorly made nails, a portion of which pierces the sensitive part of the foot. Fig. 1 illustrates how this may occur, even without the knowledge of the shoer, as part of the nail follows its proper course, and is clinched on the outside of the hoof, as if it were the whole nail. Even if the splinter has so pricked the horse as to convince the shoer of the fact, and he attempts to draw the nail, it will often break off and leave a piece in the foot, to remain a festering cause of lameness, it may be for life. In Fig. 2 is represented a nail which has splintered in the foot, and broken when being drawn out. It is said that this nail was made from cold rolled iron, and slivered when being driven by a shoer in Providence, R. I. C represents the part which was clinched on the outer surface of the hoof; A, that which was driven through the soft lamina lining the hoof, and into the coffin bone, where it was broken off. Lockjaw followed and resulted in a loss of a $1,000 horse. There was less difficulty of this kind in the days when blacksmiths made their own nails from the best Norway iron; but of late years, since machine-made nails, costing but a fractional part as much, have come into use, lameness from this cause has been frequent and expensive. To make a horse-shoe nail by machinery, which would be equal in texture to the hand-made nails, and could be sold at a low price, has been the effort of the Putnam Nail Company of Boston, Mass. After years of experimenting, they perfected machinery which, essentially, is a series of small hammers that, in operation, pound upon a rod of hot iron, turning out a finished, pointed nail, in every respect equal to any made by hand. It is well known that iron shaped by machinery, when cold, readily splinters, as may be shown by twisting a piece of wire.

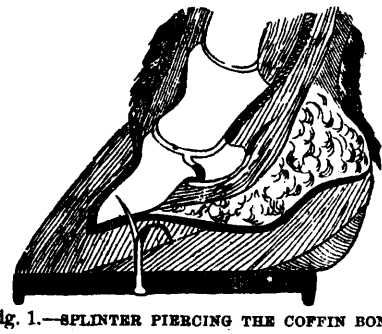


Fig. 1.—SPLINTER PIERCING THE COFFIN BONE.

Fig. 2.—KILLED A $1,000 HORSE.

RAW-HIDE HORSE SHOES.

A method of shoeing horses with raw-hide has long been in use on the plains, and found so serviceable and convenient that it might doubtless be found useful in many places where there are long periods of hot weather. There are also cases frequently occurring, in which disease of the feet might at least be alleviated by the temporary use of shoes cut from raw-hide or properly prepared sole leather. With these, that portion of the foot which needs the most precaution, viz., the crust or wall of the hoof where it meets the sole, will be preserved from contact with hard or rough surfaces; while the frog, generally too much protected, will reach the ground and become subjected to healthful action. For farm work, upon smooth soils free from stones or gravel, this kind of shoe will be useful during the summer season. A simple strip of raw-hide or sole leather, well filled with hot pine tar to make it hard and waterproof, will be sufficient for general use. A more durable shoe may be made of two or more thicknesses, fastened together by copper rivets as shown in the illustration.

A NOVEL SYSTEM OF BRICK BURNING.

Quite a startling novelty in brick burning is reported from England and is said to be in successful operation. The kiln, in its construction, resembles a single tunnel, about 108 feet long, 8 feet wide, and 11 feet high to the crown of the arch. The bricks from the machines are carried on a belt to a strong iron wagon with a clay top, standing close to the machine, and when 50,000 have been set in position, it is taken to the inlet end of the kiln, which contains nine wagons, and as the load of green bricks is admitted at the inlet end, one is passed out at the other end ready for the purchaser. The fires operate from four small furnaces in each side of the kiln in the centre of the length, while those from the centre to the outlet end are cooling, and those from the centre to the inlet end, where a small chimney stands, are getting treated, and which in their turn are subjected to the direct action of the furnaces; four to six hours complete the burning operation. It is surprising, considering the small structure, the quantity that can be passed through, 15,000 to 20,000 per twenty-four hours, which are burnt at a cost of only 3d. per 1,000, and the time occupied in the passage of the bricks through the stages of drying, burning, and cooling does not exceed three days. The iron wagons do not suffer from the heat, cold air being circulated freely under the clay bottom, but is excluded from penetrating above it. The kiln is quickly erected, costing about $2,500, including wagons and all appliances for working it. If used for temporary purposes, three-fourths of its cost is readily portable; in working, wheeling on barrows is avoided. There are no stacks to build and plaster, and the waste of bricks that are used for that purpose avoided; the bricks only being handled once in a green state very much preserves the quality, and about 20 per cent. of the labor used in brick making is avoided; and small orders for special shaped bricks can be supplied in three days.

CLOTHES-MOTHS, AND HOW TO GET RID OF THEM.

Professor C. V. Riley gives the following very interesting account of clothes-moths, and indicates the best method of killing them:

"The name clothes-moths is applied to several distinct but similar species of minute moths belonging to the family *Tineidæ*, which, in their larval state, are very destructive to woolen goods, fur, skins, feathers, and similar substances. Among them may be mentioned the clothes-moth (*Tinea vestianella*), the carpet-moth (*T. tapetzella*), the fur-moth (*T. pellionella*), and the hair-moth (*T. crinella*). These *Tineidæ* have slender bodies and lanceolete, deeply-fringed wings that expend six-tenths or eight-tenths of an inch. The antennæ and palp are short and thread-like, and there is a thick orange or brown tuft on the forehead. The colors range from buff to drab and dark-gray. The eggs are laid in May and June (the moth dying immediately afterward), and hatch out in fifteen days.

"The young worms at once proceed to work, gnawing the substances within their reach, and covering themselves with the fragments which they shape into hollow rolls and line with silk. These rolls are by some carried on their backs as they move along, and by others fastened to the substance they are feeding upon, and they are enlarged from time to time by additions to the open extremities, and by portions let into the sides, which are split open for this purpose. In such ambush the worms carry on their work of destruction through the summer; rest, in seeming torpor, during the winter; and change to chrysalids early in the spring. They transform again in twenty days, and issue from their shelter as winged moths, to fly about in the evening till they have paired and are ready to lay eggs.

"Then follows an invasion of dark closets, chests and drawers, edges of carpets, folds of curtains, and hanging garments, and the foundation of a new colony is swiftly laid. The early days of June should herald vigorous and exterminating warefare against these subtle pests. Closets, wardrobes, all receptacles for clothing, should be emptied and laid open, their contents thoroughly exposed to light and air, and well brushed and shaken before being replaced. In old houses much infested with moths, all cracks in floors, wainscots, shelves, or furniture should be brushed over with spirits of turpentine. Camphor or tobacco should be placed among all garments, furs, plumes, etc., when laid aside for the summer.

"To secure cloth linings of carriages from the attacks of moths, sponge them on both sides with a solution of corrosive sublimate of mercury in alcohol, made just strong enough not to leave a white mark on a black feather. Moths may be killed by fumigating the article containing them with tobacco or sulphur, or by putting it, if practicable, into an oven heated to about 150° Fahr."

The following United States Patents were granted to Canadians during the months of July and August last:

R. Kirkpatrick, of Richmond, N.B., July 2, 1878, No. 205,559, "Weighing Device."

R. D. Chatterton, of Cobourg, Ont., July 9, 1878, No. 205,838, "Car Coupling."

W. Morrison, of Toronto, Ont., July 9, 1878, No. 205,756, "Chemical Fire Engine."

W. H. Morrison, of Toronto, Ont., July 9, 1878, No. 205,891, "King Bolt."

G. Bartlett, of Gananoque, Ont., July 23, 1878, No. 206,213, "Wheel Hub."

G. R. Prowse, of Montreal, Que., July 23, 1878, No. 206,260, "Animal Poke."

J. Haggas, of Uxbridge, Ont., July 30, 1878, No. 206,560, "Feeding Locomotive Tenders."

J. W. Elliot, of Toronto, Ont., August 6, 1878, No. 206,769, "Fire Pot and Grate."

J. Paradis, of Longueuil, Que., August 6, 1878, No. 206,747, "Manufacture of Shovels and Spades."

G. R. Ingalls, Abercorn, Que., August 6, 1878, No. 206,792, "Milk Coolers."

J. Robertson, of Montreal, Que., August, 6, 1878, No. 206,829, "Manufacture of Plumber's Traps."

E. R. Whitney, of Magog, Que., August 6, 1878, No. 206,846, "Grain Binders."

S. Coxon, of Toronto, Ont., August 13, 1878, No. 206,933, "Signal Lantern."

E. Wassell, of Digby, N.S., August 20, 1878, No. 207,228, "Pier."

J. S. Bogue, of Montreal, Que., August 27, 1878, No. 207,487, "Calculator."

J. Stuttaford, of Ottawa, Ont., August 27, 1878, No. 207,566, "Peg for Stringed Instruments."

NEW RULE IN TRADE MARK CASES.

Commissioner Paine of the Patent Office has lately adopted a new and very excellent rule in trade mark cases, which consists in dividing the payment of the government fees, so as to lessen the expense of applying for registrations.

The government charges for every trade registration are twenty-five dollars, and heretefore the rules of the Patent Office have required the payment of the whole amount in advance, before the examination of the case. If on the examination it was found that the proposed trade mark was old, or if for any other reason the case was rejected, then the applicant was obliged to lose the whole of the fee paid.

By the new rule now promulgated by Commissioner Paine, the applicant pays only ten dollars in advance. If the case is rejected he has no more to pay; but if registration is allowed he then pays the balance, fifteen dollars.

The new rule will promote public convenience and have the effect to increase the number of applicationss for registration. Full particulars how to apply for trade mark registration, expenses, etc., will be found in the "Scientific American Hand-Book," which may be had at this office by all who choose to send for it, free of charge.—*Scientific American.*

OBTAINING PATENTS.—The work required to prepare a patent case is trivial compared with the work often necessary to prosecute cases after once sent to the Patent Office. It is frequently the case that the drawings and papers can be prepared within an hour or two, but the subsequent work, in watching it through every stage in the Office, and in seeing justice done to your client, will make up for the ease with which the case is prepared. To secure strong, equitable claims is the duty of the honorable attorney, and not to push it through in the shortest time. One-half of the worthless patented claims to-day are the result of eagerness on the part of attorney or patentee to secure the patent. A claim can be worded so as to mean nothing at all, or to embrace a combination which conveys no security to the patentee. Such claims usually result where no other object is sought for on the part of the attorney but the patent—and his fees. It will pay to procure competent counsel and remunerate him accordingly.

[If the writer of the above had said that it is as much the fault of patentees themselves who resort to patent agents who, to obtain business, work on half fees, because their talent will not obtain for them sufficient patronage otherwise, he would have hit the mark exactly.—ED. C. M. M.]

INTERESTING ITEMS.

M. Leon Say is about to visit this country for the purpose of studying the postal and telegraphic systems.

An International Art Exhibition is to be held in Munich next year, and thenceforth every fourth year.

Mr. John Hollingshead affirms that the electric light on a large scale can be produced at half the price of gas.

The *Cape Standard and Mail* states that a very extensive deposit of coal has been discovered in the Free State, near the Transvaal River.

Messrs. Bright Bros. are laying a wire from their Rochdale manufactories to their Manchester warehouses, to be worked by telephone.

A French gentleman who has visited Cyprus for commercial purposes says there will be no profitable business doing in that island for three or four years to come.

The Chinese are fast getting their revenge of the foreigners, especially the English, for compelling them to open their ports to the outside world. They are steadily getting the commerce and trade of nearly every land, originally established by foreigners, into their own hands; and it is said that from three-quarters to four-fifths of the commerce, great and small, of the country, introduced by the British, Germans and Americans, is owned and controlled by the natives. These are so very shrewd and so contented with small profits, and can live on so little, that the people of other nations can in no manner compete with them. They crowd out all other races, and the time seems not distant when they will be likely to have everything their own way.

Plaster of Paris Figures.—Plaster of Paris figures are cast in plaster of Paris moulds. When the molds are in pieces, so as to be removed from the cast with ease, they are called safe or piece moulds. The pieces are saturated with boiled oil, and are oiled slightly every time they are used. When the pieces are numerous they are covered with an outer case—also of plaster of Paris—in two pieces. The mould is fitted together, bound with strong cord, the gauged plaster (plaster mixed with water to the consistence of batter) is poured into the mould, and the mould turned about so as to insure a nearly equal thickness of plaster in every part of the cast. When the cast has set or hardened the mould is carefully removed, and the process repeated if more casts than one are required. The thin ridges covering a rough plaster cast are the marks left by the joints of the mould. A waste mould is made by covering a figure modelled in wet clay or wax with plaster of Paris. The mould is in two pieces if the model is of clay, in which case, when the plaster is hard, it is forced off the clay figure, and the latter picked and washed out of every part. If a wax model is used it may be melted out by placing the mould in a dish or pan over a stove. The plaster mould is then soaked in water until perfectly saturated and filled with gauged plaster. When the cast is set hard, the mould is chipped off with a carpenter's chisel and mallet, care being taken not to chip off any part of the inclosed figure. This process is called "knocking out." To guard against injury to the cast the waste mould is usually made of plaster coloured with red or yellow ochre. Large moulds are strengthened with rods of iron bent as necessary and imbedded in the plaster.

An Instance of English Vandalism.—An English tourist mob has broken into the Louvre and smashed a vase. One James Orsden was in the second room of the Musée Compana, looking at the objects in terra-cotta, and enjoying the solitude of the place, when a crowd of two hundred tourists, led by a man who spoke broken English, rushed in helter-skelter. Suddenly James aforesaid heard a faint shriek, succeeded by a crash, and lo! one of the two large vases from Cyprus, between four and five feet high, which he had been admiring, had been pushed over from its pedestal, and lay in a hundred pieces on the floor. The custodian was quickly on the spot to protest against the destruction of an art treasure. This was one of those "personally conducted parties" which advertisements have commended to the public of all climes, and the cicerone was equal to the occasion. "Well, it cannot be helped, but I cannot have my party interrupted in this manner; we are already late. You know me, you know Mr. ——; send in your bill, but I won't have my party interrupted any longer." So the crowd swept on. Presently the *chef* was on the spot; he ordered the fragments to be collected in a basket, and in a few minutes a vacant pedestal was the only thing to show that a treasure which had escaped for centuries the vicissitudes in its own country, and the perils and destruction of revolution and commune in the land of its adoption, had fallen at the hands of English travellers. James followed the mob, and only heard the guide remind his people that every picture in the Salon Carré was a masterpiece, and that "that one by Murillo" had cost $25,000. Four stragglers, standing before Teniers' "Kermesse," were amused by the antics of the Dutch boors at the country fair, and the eldest of the group, in order to emphasize the remark, "By jingo, these two are having a foine toime of it," actually gave the painting a rap with his walking-stick.—*The London Times.*

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

A Varnish made of Canadian balsam, dissolved in turpentine, supplies a most valuable means of making paper transparent. The mode by which this is most satisfactorily accomplished is by applying a pretty thin coating of this varnish to the paper so as to permeate it thoroughly, after which it is to be coated on both sides with a much thicker sample. The paper is kept warm by performing the operation before a hot fire, and a third or even a fourth coating may be applied, until the texture of the paper is seen to merge into a homogeneous translucency. Paper prepared according to this process is said to come nearer than any other to the highest standard of perfection in transparent paper. Care must be used in making, as the materials are highly inflammable.

Explosiveness of Flour.—Professors Peck and Peckham, of the University of Minnesota, have been making a series of experiments on the explosiveness of flour to determine the causes of recent disastrous flour-mill explosions at Minneapolis. The substances tested were coarse and fine bran, material from stone grinding wheat; wheat-dust, from wheat-dust houses; middlings, general mill-dust, dust from middling machines, dust from flour-dust houses (from stones) and flour. When thrown in a body on a light all these substances put the light out. Blown by a bellows in the air surrounding the gas flame the following results were obtained: Coarse bran would not burn. Fine bran and flour dust burn quickly, with considerable blaze. Middlings burn quicker, but with less flame. All the other substances burn very quickly, very much like gunpowder. In all these cases there was a space around the flash where the dust was thick enough to ignite from particle to particle, hence it remained in the air after the explosion. Flour-dust, flour middlings, etc., when mixed with air thick enough to ignite from particle to particle, and separated so that each particle is surrounded by air, will unite with the oxygen in the air, producing a gas at high temperature, which requires an additional space, hence the bursting. There is no gas which comes from flour or middlings that is an explosive; it is the direct combination with the air that produces gas requiring additional space. Powerful electric sparks from the electric machine and from the Leyden jar were passed through the air filled with dust of different kinds, but without an explosion in any case. A platinum wire kept at a white heat by a galvanic battery would not produce an explosion. The dust would collect upon it and char to black coals, but would not blaze nor explode.

LEAD POISONING BY BREAD.

The people in a populous district of Paris suffered lately from lead poisoning, and Dr. Ducamp traced the cause to the bread used. The baker from whom it was obtained, as well as his family, were equally affected. The flour, water, and yeast used by him were of the same kind as that used by neighbouring bakers, and contained no lead, while the bread he sold did contain it. Finally, it was discovered that he had heated his oven with old boards taken from demolished buildings. These boards had been painted with white lead, which, during combustion, was volatilized and deposited all round in the oven. It was then found that the persons employed to dust the bread from adhering ashes, etc., were the first and worst affected, while in one family where an old person ate the soft part and the young ones the crust, the first remained free while the latter were the most severely attacked.

If we closely examine a flat, square, or half round file, we shall find that the cutting edge of the teeth does not come fully up at the corner; hence neither of them will file a clean corner, but leave it slightly round. To remedy this defect the only plan is to grind away the edge of the flat or one side of the square file, making it smooth, or as least so that the teeth points will meet the corner. Care should be taken to select the worst side of the file to grind away, and this will be the side hollowest in its length. Sometimes a smooth half round file is used to square out a corner, in which case the smoother the file the better.

Safe edge files are those which have one edge left without teeth, so that it will not cut, the object being to enable that edge to be moved against a flange or projection of the work without cutting it. As a rule, however, it will be found that cutting the teeth on one side throws a burr over the edge, and it is necessary, unless in very fine piles, to pass the safe edge over the grindstone to make it absolutely safe.

In using parallel files for keyways, it is often necessary to finish with the end of the file only, so as to take any roundness in the keyway surface. It is to be especially noted that by giving the file a slight lateral motion at each forward stroke, and reversing the direction of that motion, so that the file marks cross, there will be less liability for the file to pin, and the file will cut more freely, but with a lateral motion, from right to left the file cuts cleanest. This is because the deepest serrations forming the file teeth are diagonal and nearest to the end of the file on the left-hand side, hence with a motion from right to left there is a partial draw-filing motion. For finishing, very light strokes should be taken, the cross-filing being done with smooth files before the draw filing is begun, and to prevent pinning, a frequent application of chalk should be given to the file teeth.—*Scientific American.*

AN IMPROVED FLEXIBLE HARROW.

The accompanying engraving represents the improved flexible harrow invented by Mr. James M. Flower, of Malvern, Ark.

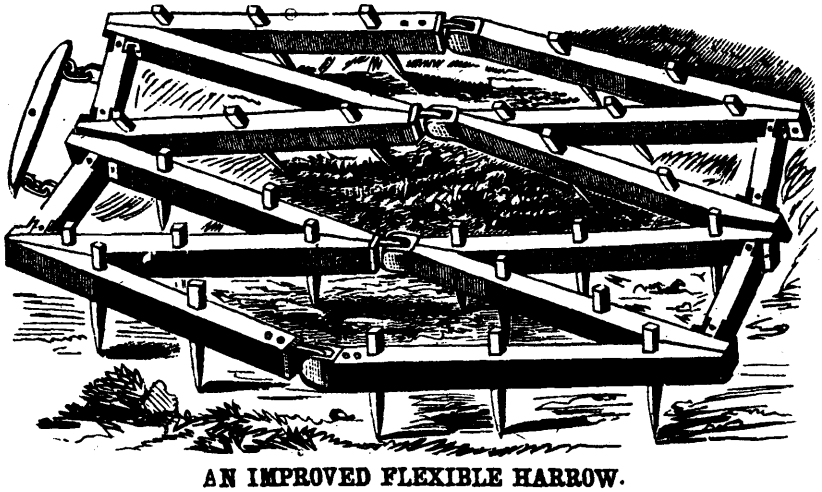
The object of this invention is to furnish an improved harrow which shall be so constructed that the teeth may be wide apart, so that it will not clog with stones, sods, stubble, corn-stalks, &c., and which shall be simple in construction, light, strong, and durable, and effective in operation, pulverizing the soil very finely.

The frame of the harrow is made in four sections, each section being formed by arranging three bars of suitable length and size, in the form of the letter N—that is to say, two of the bars are parallel, and are connected at their alternate ends or diagonally by the third bar. The bars of each section are connected at one end by a cross or brace-bar, the ends of which are secured in cast iron sockets, attached to the ends of the said bars. The sections are connected together in pairs at their open ends by iron hinges.

One pair of the sections are turned over, and the two pairs are then connected together near the outer ends by iron hinges, the cross-bars thus forming the end bars of the harrow.

The teeth are inserted in the bars about eighteen inches apart, so that rubbish may easily find its way between, while, from the peculiar form of the frame, the paths of the teeth will be close together, and the soil will be very finely pulverized. To the cross-bars at either end, is attached a draw-bar, to which the double-tree is attached by a clevis, in the usual way.

By this construction the harrow will be exceedingly flexible, so that it will accommodate itself to any and every inequality of the surface of the ground.—*American Inventor.*



AN IMPROVED FLEXIBLE HARROW.

RETARDED FRACTURE IN TOOL STEEL.

A paper was read before the late meeting of the American Society for the Advancement of Science, by Wm. Kent, describing a peculiar case of fracture in tool steel. From this paper we take the following paragraphs: Mr. John L. Gill, Jr., of the Pittsburgh Car Wheel Works, Alleghany City, had occasion to use in a machine which he is building a cylindrical piece of tool steel, 10 inches long, and two inches in diameter, with a curved groove cut on one side and a rectangular groove on the opposite side, parallel to the axis. The steel was procured from a well-known firm, and stated by them to be the very best tool steel. It was supposed to contain about 0.9% of carbon. That the steel was of excellent quality is shown by the fact that another piece from the same bar was made into a rose reamer, which has been in use for some time in Mr. Gill's shop without showing a flaw. The reamer and the piece which broke were tempered by the same blacksmith, an experienced hand.

After the piece was formed into the required shape, it was tempered by being carefully heated in a wrought-iron muffle, then plunged into water and cooled. It was then oiled, and held close enough to the fire merely to burn off the oil, the object being to have the piece extremely hard. It was then laid away on a shelf, to be used when the machine for which it was made was ready for it. The machine being delayed the piece was not needed as soon as was expected and it lay on the shelf for six weeks. One night, at the end of the six weeks, the watchman of the works heard in the shop a report like a musket shot, and on going towards the shelf on which the steel had been placed and from which the report sounded, he found that the piece had broken in two, one of the broken pieces falling on the brick floor, four feet in front of the shelf, the other having apparently recoiled against the board wall behind the shelf, leaving a deep dent in the board. The fractures are of a peculiar curved or concave and convex form, and the structure shows a fine grained and superior metal.

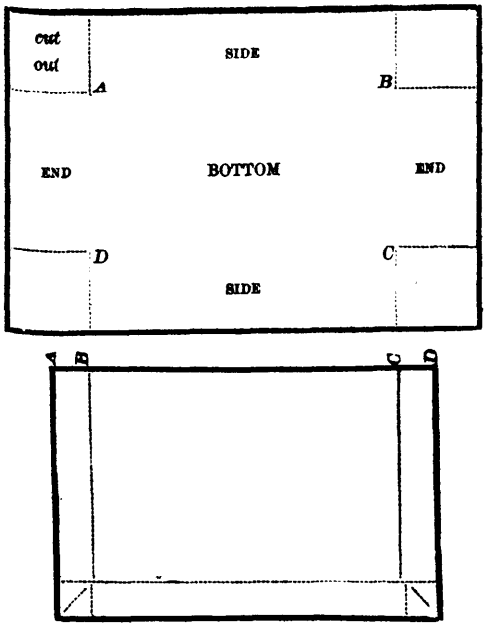
The various theories of internal strain will at once suggest themselves to those inquiring into the cause of this and similar accidents. It is almost certain that a condition of internal strain existed in the piece of steel during the whole six weeks that it lay on the shelf. It may be possible that the interior portion of the piece during all that time was compressed by the greater contraction of the exterior portion, and that it resisted this compression with a constant and uniform force, while the resistance of the exterior portion to this force gradually diminished, becoming weaker until it "let go" suddenly, and the piece broke with a loud report. Admitting this theory, however, the difficulty arises, "if the exterior portion 'let go,' why did the interior also break, its strain being relieved?" The "shock of rupture" may be the answer to this querry.

TO MAKE A LEAD TANK.

Plan the cutting of your sheet lead so as to make as short joints as possible; if the tank is to hold water, use good easy flowing solder; if it is to hold acid, burn the seams; if you cannot do this, use very coarse solder, as the acid will act upon it much slower than when the solder is fine.

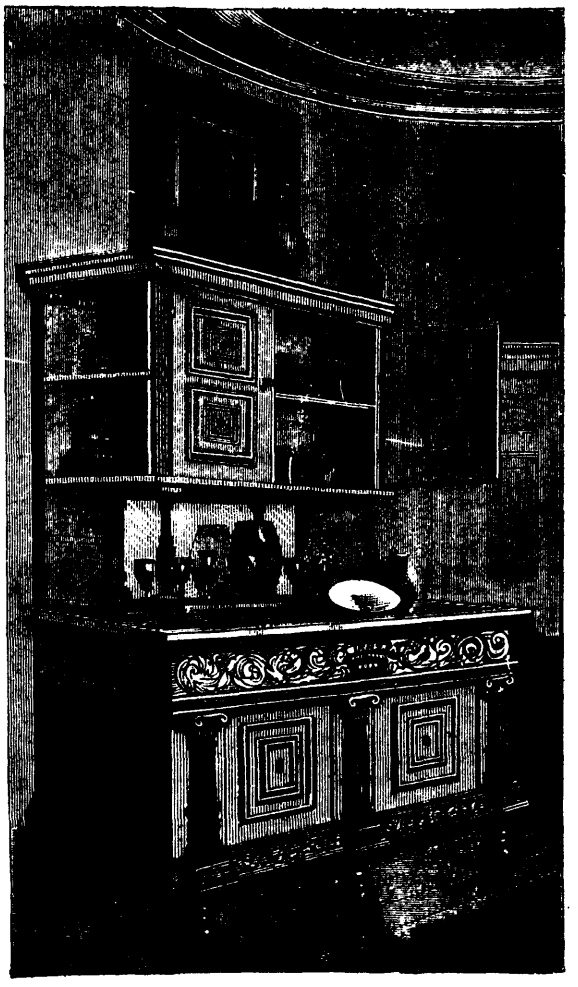
If the tank is very *shallow* and long and wide, cut as follows, and wipe seams in the corners; this will save the seams from *a* to *d* and *b* to *c* and the solder saved will more than pay for loss of lead cut out of the corners. If the tank is *deep* and *lo g*, cut the sides, bottom and lapping for top edges of box of one piece of lead, and the ends of two other pieces; this will make two seams in the *corners* of the box, one at each end. If the box is *small* and lead *light*, and you wish to make joints with copper bolt, put your bottom and sides in one piece *falling short* 2 inches at each end, instead of allowing the edges to join in *corners*, then cut your ends folding in the corners to meet the bottom sheet, dress the edges of lead into a small groove cut in box under where the seam will come, and run the seam with the copper bolt.

Fold corners as shown by dotted lines. *B C* is the length of end of box, *A B* and *C D* the distance the bottom lead falls short of the length of tank at each end. After laying out the pieces of sheet lead as above, multiply length and breadth and weight per square foot to get the quantity of material. The quantity of solder will vary from 1 to 3 lbs. per foot of joints according to the way it is wiped; do not forget to allow enough lead to cover the top edges of the box, and to drop down a ½ inch on the outside where a row of tinned tacks with large heads should fasten the sheet lead.



SHORTENING A BELT.—It is frequently convenient to shorten a belt temporarily, especially in the upper stories of a mill, when the miller would be put to some trouble and the loss of considerable time to shorten the belt in the customary way. In such cases, we have heard the following simple method recommended, which will answer very well where the belt does not run near a beam or other obstruction: Unlace the belt and place the two ends together, making the laced portions parallel, and allowing them to project away from the pulleys. They may then be laced again, using the same holes and fastenings. Though very simple, this hint may save annoyance and time.

AN APT COMPARISON.—The late M. Ste. Claire Deville was one day discussing with a famous anatomist the subject of the advance of knowledge. "After all," he said, "you have made great advances; but don't you think you are very like the hackmen, who know all the streets, but haven't the remotest idea of what is going on in the houses?"



CABINET—FROM "ART IN THE HOUSE."

ALCOHOL IN THE SYSTEM.

We find in *Hall's Journal of Health* a vigorous article in reply to an English review which upheld alcohol as a food, &c. The article is long and forcible, but we have space only for the general summing up, as follows:

If alcohol is not a poison, but food, because alcohol gives force, muscular power—then, arsenic is not a poison, but food, because arsenic gives force, muscular power.

As nature has formed no element in its purity, which element in large dilution is necessary to health, we conclude that such element in its purity is not essential to health.

As men have lived in perfect health without alcohol, the use of alcohol cannot add to that health, because a man cannot be better than well.

As we know of no article which contains hydrocarbon largely, which would not destroy life, if used alone, not even sugar; so we may conclude that alcohol, which does contain hydrocarbon largely, will destroy life, if used alone.

If any elementary substance in its purity destroys life, if used alone, it is reasonable to conclude that the only safe method of using any elementary substance is, in using it in the proportion in which nature has combined it with other materials: therefore, that however essential to existence hydrocarbon may be, it is not healthful or safe to use it in its concentrated, a tificial combination, but only healthful and safe in deriving our supplies of it, as contained in our natural food. Therefore, we consider it established, that alcohol is not essential to health; that it is not promotive of the health of those who are well; and that in proportion as it is used largely, or alone, in such proportion is it, like all other elementary concentrations, certainly destructive of health and life together.

OUR EXCHANGES.

We take this opportunity, at the close of the year, to acknowledge our indebtedness to several of the scientific papers published in the United States for many of their excellent articles and illustrations which we have made use of during the past year in the columns of this Magazine, but particularly to the *Scientific American, Polytechnic Review, Manufacturer and Builder, Architect and Building News, Plumber and Sanitary Engineer,* and *Mining and Scientific Press.* We trust during the coming year to offer, in return, also much interesting matter. If at any time we should neglect to acknowledge the source from which we obtain information, we trust our contemporaries will kindly call our attention to the omission.—Ed. C. M. M.

AN ECONOMICAL LOCOMOTIVE.

A new anthracite coal burning locomotive has lately been tried on the Old Colony (Mass.) Railway with very promising results. It is said that it is constructed with a largely increased fire surface in order to remove the difficulties arising from the consumption of coal in the ordinary locomotive. Rating the consumption of fuel in the ordinary locomotive at forty to fifty pounds per hour per square foot of grate surface, in this engine when doing its hardest work the consumption is said to be only sixteen pounds per hour. The fire box is behind and on a line with, instead of under, the boiler, and while in the common locomotive the dimensions are 60 and 66 by 32 inches, the new design is 8 feet 6 inches by 7 feet 6½ inches wide. The heating surface of the fire box is 103 square feet; of the combustion chamber, 26 feet. The grate rest is between water bars, which prevent them from burning out, and the area is 64 feet. The diameter of the six driving wheels is 54 inches, and above them are placed the boiler and fire box. The cab is over the rear end of the boiler, while on top of the fire box are seats, protected from the sun by an awning. The weight of the engine is 86,150. At the front end of the boiler is a revolving register, which, when open, has an area of six hundred square inches. On account of the free steaming qualities of the engine, it becomes necessary to open this register in order that the steam may pass directly to the stack without passing through the fire. The fuel used by this engine can be delivered in Boston at $2.25 per ton, or $1.50 less than the cost of fuel which is now used. As the fuel remains perfectly quiet in the fire box, the consumption is slow, and although the engine has no spark arrester, not a spark escapes from the stack; neither is there any annoyance from smoke and gas, which are consumed.

THE TREATMENT OF HYDROPHOBIA.

Mr. Stanford, a member of the English Parliament, has offered a prize of £100 for an essay on hydrophobia, its nature, prevention, and treatment, and the British Minister at Washington has brought the matter to the attention of the Department of State, that the necessary publicity may be given to the offer in the United States. The prize is to be awarded by the Royal College of Physicians of London. The questions which are thought by the college to require special investigation are: The origin and history of outbreaks of rabies, particularly in the British dominions; the best mode of prevention of rabies; the characteristics of rabies during life, and the anatomical and chemical changes which are associated with the disease in its successive stages, particularly in its commencement: the origin of hydrophobia in man, and the chemical and anatomical morbid changes observed in the subjects of the disease, with special reference to those having their seat in the organs of the nervous system and in the salivary glands; the symptoms of the disease, particularly in its earlier stages, and the diagnosis of the disease in doubtful cases, from conditions more or less resembling it, together with the alleged prolonged latency of the disease, and the efficacy of the various alleged remedies and modes of preventing it; and what plan of treatment, whether prophylactic or curative, it would be most desirable to recommend for future trial.

The conditions under which the prize is to be competed for are that the essay must be in English or have an English translation accompanying it, and be delivered to the college on or before January 1, 1880. The essay must be accompanied by a sealed envelope containing the name and address of the author and bearing a motto on the outside, the same motto to be inscribed on the essay, which may be the joint production of two or more authors. If not published by the author within a year, it is to become the property of the college.

CHARCOAL IN DENTIFRICES.

A correspondent, who is a practical dentist of large experience, sends the *Journal of Chemistry* the following note: I notice a paragraph from the *Chemist and Druggist*, referring to the use of different substances for dentrifice, which states that the "microscope pointed out that every particle of charcoal had proved to be a small crystal, which, acting by attrition, was hurtful to the enamel." If attrition or friction were the only objections to the use of it as a dentifrice, I imagine the consequence would not be very harmful; but it is absolutely dangerous on other grounds. Of course its antiseptic properties are not questioned, but the most serious danger arises from its pernicious effects upon the gums and soft tissues. I might add that in extreme cases the alveoli or sockets of the teeth are not exempt from its effects. It may be laid down as an invariable rule that no substance should be used as a dentifrice that contains acids or any ingredients insoluble in the secretions of the month. Now with regard to charcoal, the microscope reveals the fact that, no matter how finely pulverized, it is composed of minute augular crystals. These are absolutely insoluble in the month, and when used they work up under the free margins of the gums, and the more loose and diseased these are the greater the danger. The little carbon crystals get imbedded in the soft tissues, acting as a constant source of irritation which is followed by inflammation. A chronic state is reached; the gums become swelled; pus exudes from their margins; and absorption of gums and alveolar processes, with ultimate loss of the teeth, is the sequel. Of course extreme results are produced only by habitual use of the article. I think all observing dental practitioners of any considerable experience will bear me out in the above statements.

DOES RUNNING WATER PURIFY ITSELF?

This subject is discussed in the November *Popular Science Monthly* by J. A. Judson. He takes a decided negative, as will be seen by the following paragraph: It is not impossible to point out authorities on sanitary matters so wedded to pet theories that they unhesitatingly deny that the conversion of a pure running stream, or even a large river, into a conduit for the sewage-filth of a great city, will have any deleterious effect on the potable quality of the water taken a few miles below the filth-entering point. It has been demonstrated that this is not only false in theory, but also in fact. It was Dr. Letheby, of the English "Royal Commission on the Water-Supply of London," it is believed, who was the first to announce what has since been proved a fallacy, viz., that "if sewage be mixed with twenty times its volume of river-water, the organic matter which it contains will be oxidized and completely disappear while the river is flowing a dozen miles or so;" and further, that "it is safe to drink sewage-contaminated water after filtration." The "Royal Rivers Pollution Commission" of 1868, unwilling that this expression of opinion should remain untested, submitted it to careful and ingenious experimental investigation. The result is thus announced: "It is thus evident that so far from sewage mixed with twenty times its volume of water being oxidized during a flow of ten or twelve miles, scarcely two-thirds of it would be so destroyed in a flow of one hundred and sixty-eight, at the rate of one mile per hour, or after the lapse of a week." And, after mentioning details in support of this, the commissioners conclude with the remark that "it will be safe to infer, however, from the above results, that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation." Dr. Frankland, an eminent English authority, before the Royal Commission on Water-Supply, gives some strong testimony in support of the statement that it is impossible to remove the sewage-contamination from water by any known process, natural or artificial, so as to render it harmless, except by boiling for a long time, or by distillation; and, as these two processes are impracticable on a large scale, then, he says, in his opinion, "Water that has once been contaminated by sewage ought not afterward to be used for domestic purposes; and, inasmuch as it is generally believed that the noxious matter of sewage exists there in the form of minute germs, which are probably smaller than blood-globules, I do not believe that even filtration through a stratum of chalk could be relied upon to free the water perfectly from such germs."

SANITARY ITEMS.

To Cure Hoarseness.—Heat well the whites of two eggs and two teaspoonfuls white sugar; grate in half a nutmeg, add a pint of lukewarm water, stir well and drink often. Repeat the preparation if necessary.

For Smooth Hands.—After washing and drying the hands, pour into one hand a few drops of good cider vinegar; rub the hands together, wetting the whole surface, both sides, and dry it. Practice this and your hands will feel smooth.

For Severe Burns.—If you cannot obtain lime water ready made, take unslacked lime and pour water on it. When the water is drawn off clear, mix flaxseed oil with it until it becomes yellow and thick like syrup. Apply to burns at any stage, the earlier, however, the better. We publish this because we are confident it is the best application for severe cases, as well as slight burns. It should be kept on hand always.

Mrs. Partington on Diseases.—Diseases is very various—very. The doctor tells me that poor old Mrs. Haze has got two buckles upon her lungs! It's dreadful to think of—'tis really. The diseases is so various! One day we hear of people's dying of "hermitage of the lungs," another of "brown-creatures;" here they tell us of the "elementary canal" being out of order and there about the "tear of the throat;" here we hear of the "nemrology in the head" and there of an "embargo" in the back. On one side of us we hear of a man getting killed by getting a piece of beef in his "sarcofagus," and there another kills himself by "deskevering his jocular vein." These things change so that I don't know how to subscribe for any thing now-a-days. New names and "rostrums" take the place of the old and I might as well throw my old yerb bag away.

Keep the Head Cool.—An interesting paper was read at a recent meeting of the Royal Society on "Experimental Researches on the Temperature of the Head," in which the writer, Dr. Lombard, showed that mental activity will at once raise the temperature of the head, and that merely to excite the attention has the same effect in a less degree. This is a curious result, as appearing to show that anything of the nature of volition involves a waste of nerve tissue which is not involved in involuntary perception and observation. There is no difference, we believe, between the temperature of the sleeping body and that of the waking body, or between that of the waking body and that of the head, so long as no act of effort is involved. But if even the least intellectual effort raises the temperature of the head above that which it reaches in amused and idle observations, it would seem to show that there is a waste involved in volition which belongs to no so-called "automatic" action of the mind. And that is itself a fact of no slight significance.

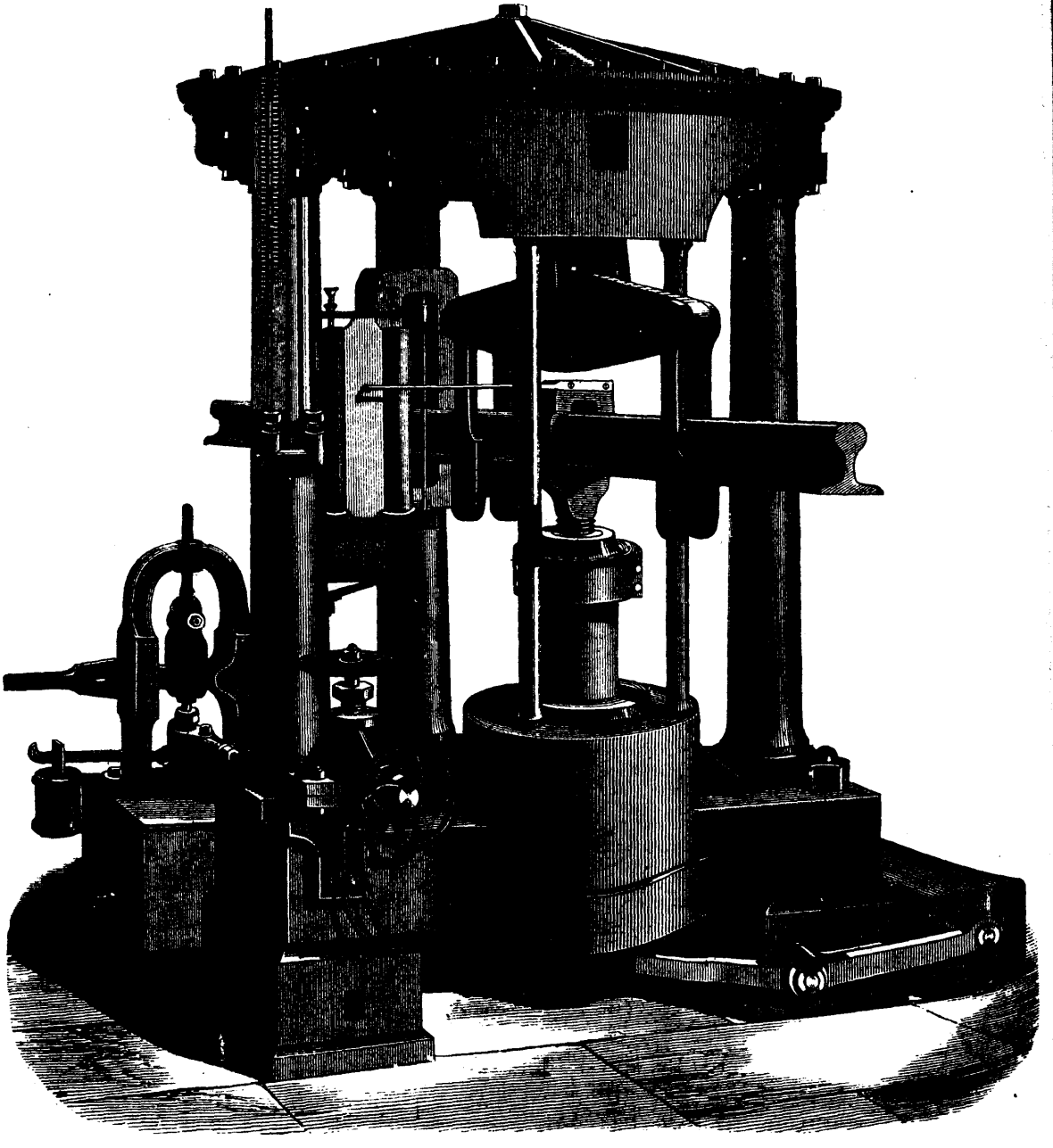
Influence of Exercise on the Lungs.—One of the conditions of perfect health is physical exercise. In its absence the whole system suffers deterioration and falls short of that development which is necessary to the vigorous action of the different organs. More than any organ, however, do the lungs suffer; and it is not difficult to explain why. In order that an organ should be well nourished, it is necessary that it should be abundantly supplied with blood, and one of the agencies which play an important part in propelling the blood through arteries and veins is muscular contraction. The alternate contraction and dilation of the muscles forces the blood along the vessels. When a person is exercising vigorously, the respiratory movements become greatly increased, the air vesicles become dilated, the blood is propelled through the minute capillaries which constitute a large portion of their structure, and the lung tissue receives the nourishment which it requires, and what is necessary to its integrity and efficient action. From insufficient bodily exercise, then, the lungs suffer in two ways—viz., for want of sufficient blood to nourish them and for want of necessary expansion. The result is that the lungs, more frequently than any other organ, become affected in those who lead inactive lives. This fact makes it incumbent on all, and especially on those who have weak lungs, to spend a portion of each day in vigorous physical exercise. We mean by this exercise which calls into vigorous action all the muscles of the body; exercise which causes the skin to glow and the perspiration to start. Two hours of this kind of exercise each day is not too much; and it should be performed, when possible, in the open air. A celebrated French physician says that a person, to be healthy and strong, should exercise to the point of perspiring every day.

Boxing Children's Ears.—The practice of boxing children's ears is a most dangerous one. Professor Stanich, aurist, in a letter to the Timaru *Herald*, says: "As one single instance, in Canterbury I have found no less than four children in one family affected with serious deafness. One of these little ones had the drums of both ears absolutely broken, which means, of course, incurable deafness. The parents assured me that they never struck their children, but that it was in school that the boxing of the ears, which had had so fatal results, had taken place. I understand, also, that more than one schoolmaster in Timaru is in the habit of resorting to this barbarous practice as a means of punishment, and who—unwittingly no doubt—will be answerable for many a case of deafness in years to come, when their present pupils will have reached manhood and womanhood." When the barbarous practice of beating children in school is resorted to, preferring a charge of assault against the teacher would have a moderating influence. If children are utterly disorderly they should be expelled from the school, and the onus of punishments thrown on the parents, who, if they neglect the proper correction of their children, would have the pleasant reflection that the reformatories or training schools would be the places to which incorrigible children would be sent.

Warm and Dry Feet.—Life long discomfort and sudden death, writes a medical man, often come to children through the inattention or carelessness of the mothers or nurses. A child should never be allowed to go to sleep with cold feet; the thing to be first attended to is to see that the feet are dry and warm. Neglect of this has often resulted in dangerous attacks of croup, diptheria, or fatal sore throat. Always on coming from school, on entering the house from a visit or errand in rainy, muddy, or damp weather, the child should remove its shoes, and the mother herself should ascertain whether the stockings are in the least damp. If they are, they should be taken off, the feet held before the fire, and rubbed with the hands till perfectly dry, and another pair of stockings and another pair of shoes put on. The reserve shoes and stockings should be kept ready for use on a minute's notice.

Rescue of Drowning Persons.—The best way to rescue a drowning person is to carefully approach him from behind so that he cannot grasp you. Turn on your back under him, get his head upon your chest, and grasping him firmly with either one or both hands by the hair or else by the neck under the jaws, strike out with your feet. To practise this method, as I have been doing within the past week or two, get a friend who can float on his back, and try as above, and you will be surprised how easily it can be done. The person does not seem to be any incumbrance whatever. The awkward point is to turn underneath, but a little practice will soon get over it. This is not only the best way, but I firmly believe is the only way suited to rescue non-swimmers. There is another way that will do for those who can keep cool in the water (which 99 out of 100 cannot) when off their feet. That is for the person to put his hands lightly on your shoulders just so as to be able to keep his mouth above water, both being in the ordinary swimming position. You cannot be too careful with whom you practise this way. All other methods which I have tried only result in a turning round of the persons in the water without any advance. There has been a little discussion lately about keeping the eyes open when under water. There is a common error which first arose in Franklin's advice to swimmers, that if the water is entered in diving with the eyes shut they cannot be opened. This is a glaring fallacy. I have never had the least difficulty in opening and shutting my eyes when under the water, nor never heard of anybody who had. I cannot enter the water with my eyes open when diving in, and I think that the eyes will always involuntarily close, dreading the shock with the water. It may be that the winking may be so quick as to be unnoticed, but still it is there. I cannot imagine how a person like Dr. Franklin ever came to circulate this delusion.

Rheumatism.—A correspondent says,—By all means try a purely vegetarian diet--that is if you want a thorough cure, and not a "patch up." I know numbers who have been perfectly cured by a vegetarian diet. I have been myself a strict vegetarian and abstainer from all drinks except water for three years, and the result is perfect health, experience of hundreds of others who have tried this mode of diet. Don't be influenced by others who have ever given it a fair trial. A three months' trial of vegetarianism and you will never again know the agonies of rheumatism. is



TESTING MACHINE AT PARIS EXHIBITION. FIG. 1.

TESTING MACHINES AT THE PARIS EXHIBITION.

Messrs Chauvin & Marin-Darbel, of Paris, have somewhat numerous exhibits of their manufacture at the Exhibition, among the rest some testing machines of a type which they brought out in 1876, and which we illustrate by the engravings on the present and opposite pages, for which we are indebted to *Engineering*.

Fig. 1 represents a 60-ton machine for tension, compression and bending, shown in the engraving as arranged for bending stress. Fig. 2 shows the apparatus used for registering strains in the same machine when it is used for extension or compression. Fig. 3 is a machine for testing wire, and Fig. 4 a machine for testing paper, woven fabrics, or threads. All these machines act on the same principle, which may easily be described by the help of Fig. 1. Attached to the entablature of the machine, which is supported by three cast iron columns and two smaller ones of wrought iron, is a cast iron cover, slightly conical. Below this cover is a similarly shaped diaphragm, supported round the edge by a ring of India rubber so as to permit its motion up and down. The diaphragm fits up into the cover so that only a small space is left between the surfaces of the two. This space is filled up with water, all the air being carefully expelled from it. The lower portion of it is then put in communication with a bent tube filled with mercury, the outer end of which is open and stands above the level of the top of the machine, as shown attached to the left hand column in Fig. 1. It will be readily understood that under these conditions the separation of the diaphragm and the cover, that is to say, the pulling down of the former, is resisted by the atmospheric pressure from below. As the separation is effected the mercury passes from the tube into the space between the two surfaces, and the depression of the level of the mercury forms a measure of the amount of separation

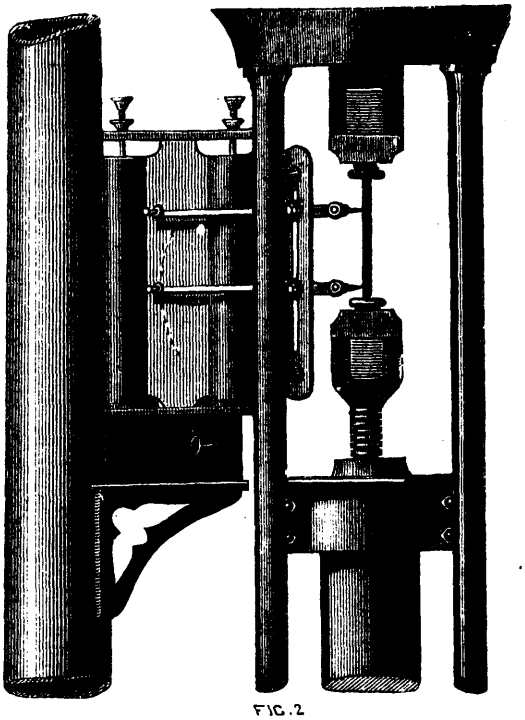


FIG. 2

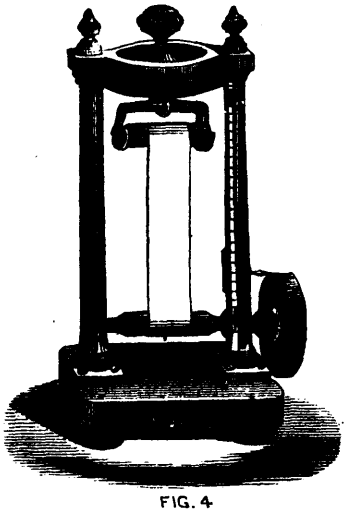


FIG. 4

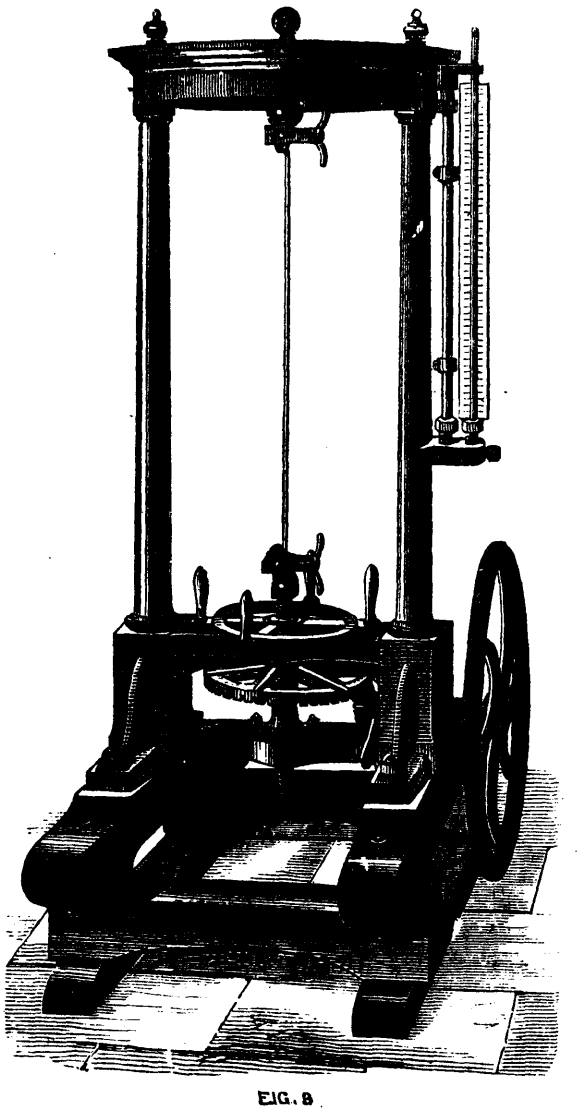


FIG. 3

TESTING MACHINES AT THE PARIS EXHIBITION.

which has taken place, and hence of the force which must have been exerted to cause that separation.

Underneath the diaphragm, and connected with it at the center, is placed a lever, one end of which is fixed and the other attached to the object to be tested. In Fig. 1 this attachment is made to a second lever hanging links and knife edges for the rail which is to be bent. The lower end of the test piece (or as in Fig. 1, the center of the bar to be bent) is connected to the upper end of a hydraulic ram, the cylinder for which forms part of the base plate of the machine. The ram and parts connected with it are balanced by a counterweight carried by levers, shown to the right of Fig. 1. The load is applied to the test piece, as usual, by simply pumping water into the ram cylinder, and so forcing down the ram. At the side of the column of mercury are scales on which the alteration in its level can be read, the one being marked in kilogrammes simply, the other in kilogrammes per square millimeter. The scales are movable, so that the zero point can be adjusted at each experiment to the level of the mercury, which must, of course, alter with the weight of the piece to be tested. The scales are determined by calculation and verified by actual application of weight to the diaphragm. Somewhat primitive apparatus is attached for recording deflections (Fig. 1) and alterations of length (Fig. 2.) It is assumed, at least in the former, that the whole drop of the diaphragm is too small to be worth measuring. The machine is made in four sizes, namely, 15, 30, 60 and 100 tons; that exhibited at Paris is for 30 tons.

The machine shown in Fig. 3 is for a maximum load of 2 tons, the same type being also made for 5 tons and for 10 tons. The entablature is here supported by two columns only, and the effort is applied by hand gearing instead of by a pump. The lever under the diaphragm is also dispensed with, the wire being attached directly to its center. The neat little machine for paper, &c. (Fig. 4), is, of course, simpler still; in it one of the columns is made to inclose the mercury gauge. Its maximum load is 30 kilos.

THE TREATMENT OF BLEEDING WOUNDS.

It is now a time of especial activity in the use of machinery and edge tools, both in the shops and on the farm. A few words about the treatment of wounds may be valuable. Dr. C. H. Allen makes the following suggestions: Bleeding is attended with more or less danger. All should observe the difference between the arterial and venous hermorrhage. If the blood flowing from a wound is of a bright colour and jets out, it shows that an artery, leading blood directly from the heart, has been wounded, and should receive instant attention, lest the sufferer should bleed to death. If the artery be very small, compress it firmly, and it may contract upon itself and the bleeding cease. But it should not be left without a continuous pressure in some form, either directly upon the tube or above it. The usual way is to bring a strip of linen or cotton cloth tightly above the limb till the bleeding stops. The artery may be larger and then the same treatment may be proper, till a surgeon may seize it with a pair of forceps, draw it out and pass around it a strong thread, or ligature of waxed twine or silk. A cut artery can never be absolutely safe unless a ligature has been securely tied. The mode of tying a ligature is of some importance. The ends of the threads should be passed around each other twice, and then drawn tightly. This prevents slipping of the thread, and secures a complete check to the flowing of the blood. These directions are important, because the life of the wounded person often depends upon the prompt and proper application of a ligature. In every agricultural school instructions on the proper mode of treating all sorts of wounds should be given. And every man who uses instruments should be familiar with the proper way of dressing wounds instruments may possibly inflict. The most cautious men are now and then careless in using sharp-edged tools. A young man was mowing. He unintentionally disturbed a nest of hornets. They returned the compliment by addressing him in a pointed way. He stumbled, and inflicted a wide and deep wound upon the calf of his right leg. His brother, then present, tore his shirt into strips, tied knots in the middle and brought some about the leg above the knee, bringing the knots under the knee more and more firmly, till the hemorrhage ceased. Two other men were mowing, when one carelessly hit the other with his scythe just above the inner ankle. The blood jetted out freely. The inflictor of the wound ran for help, and on his return found the wounded man had bled to death. Very slight pressure upon the bleeding artery might have saved his life. When one can, press the bleeding artery against the bone above the wound. The services of a surgeon are desirable, but an hour may elapse before he can reach the wounded person, so every one should be familiar with the simplest way of checking the bleeding from a wound.

If the blood flowing from a wound be dark coloured, oozing slowly in a steady stream, but not jetting as when an artery has been cut, it can easily be checked in the same way. Bleeding from a vein may cease by applying cold water, by holding the injured limb higher than the head. If the lower limbs be cut severely and the blood flow freely, place the sufferer on the ground or floor, raise the limbs upon a chair, apply a bandage firmly about the limb or limbs, and keep it saturated with cold water. By observing these directions many lives have been saved.

We have seen friends upon receiving a severe cut use a large quantity of rags, as if concealing the blood was stopping it. The compression of knots brought firmly against the bleeding artery just above the wound is worth all the rags of the known world.

A CABINET.

Drawing-room furniture, although it may be of a lighter and perhaps more ornamental description than the more solemn fittings of the dining-room, must follow the same general rules: it should be well constructed, suitable to its purpose, and thoroughly good. American walnut is a good wood for the purpose. It should be oil finished, so that it may be rubbed down from time to time and made as good as new if not better. Among the larger pieces of furniture for the drawing-room may be a cabinet such as is represented in the accompanying engraving. It is of walnut, ornamented with lighter and darker woods. The recesses and shelves have mirror backgrounds, which reflect the ornaments and give a brilliant effect to the whole.

Such a piece of furniture as this takes up the principal place in the room, and the rest of the wall space may be utilized for hanging book and china shelves, and smaller cabinets.—*Scientific American.*

Two new lines of tramway are being built in Dublin and its vicinity.

THE Ottoman Porte has granted a concession of a line from Jaffa to Jerusalem.

MANNHARDT, the well-known clockmaker and mechanician, has just died at Munich, aged 80.

OUT of all the myriad lights in the heavens, the earth is visible only to the Moon, Mars, Mercury and Venus.

BLACKING IRONWORK.—This is done by heating to a red heat, quenching in oil, and blazing off by holding the quickly-dipped iron over a fire.

ENGLISH TRIBUTE TO AMERICAN INVENTIVE GENIUS.—*Punch* says that a Yankee baby will crawl out of his cradle, take a survey of it, invent an improvement, and apply for a patent before he is six months old.

ANOTHER METHOD.—Hinges, rim lock, and small ironmongery are coated with Brunswick black, which is a solution of asphaltum in linseed oil. For larger works, melt ½lb. asphaltum and ½lb. resin in 2lb. tar oil in an iron kettle, and when cold it is ready for use.

SILVEROID is the name of a new metallic composition which has just been introduced in America in the manufacture of tableware. "It has a fine texture, is susceptible of a high finish, and can be supplied at much less cost than anything heretofore used as a substitute for real silver."

AN OBSERVATORY ON MOUNT ETNA.—The scheme for an observatory on the summit of Mount Etna is again pushed in the English scientific journals. The atmosphere there is peculiarly clear, and it is thought that some important results might be arrived at by a series of daily observations.

GUTTA PERCHA cuttings are very useful for the laboratory. By dissolving them in benzole and adding a little carmine or any other pigment, a solution is obtained which when brushed on the cork and neck of a bottle forms a tight fitting cap, impenetrable to air, dampness, alcohol and acids, and can be taken off without difficulty.

DR. SCHLIEMANN states that his excavations on the Island of Ithaca have resulted in the discovery, on the south-east part of the island, of ninety houses of cyclopean construction, belonging to the Homeric city of Ithaca. He states that the winter rains have washed into the sea all the ancient treasures, but that, nevertheless, he has made a valuable discovery in finding the ruins.

A SINGULAR case of poisoning from Paris green occurred in Rutland, (Vt.) recently. Mr. Still piled up the potato tops in his garden (on which had been used Paris green pretty freely) and set them on fire. His boy thought it was great sport to run through and stand in the smoke of the fire, and the consequence was that he got poison enough by means of the dust and smoke to produce all the characteristic effects of arsenic poisoning. Suitable antidotes were administered and the child recovered.

NOTE ON THE SOLAR SPECTRUM.—Prof. J. C. Draper, in a paper contributed to the *American Journal of Science and Art*, places on record recent researches on dark lines in solar spectrum, which possess a close relationship in position to the lines of oxygen, slight differences that exist being within the limits of error of experiment. His researches lead him to believe that to prove the presence of oxygen or other substances giving faint lines in the solar atmosphere is a problem which cannot be solved by the comparison of two spectra of small dispersion.

A RARE DISEASE.—From the *Medical and Surgical Reporter* we learn that a case of a very rare affection—the ossification of the muscles of the trunk and limbs—was presented by Dr. Nicoladoni, before the Vienna Medical Society, in the person of a girl of seven years of age. In this case, the disease was far advanced, having commenced with the muscles of the neck, whence it extended to the spine, the anterior part of the thorax, and the limbs. A number of the muscles were completely ossified. It is stated that there are only three such cases on record.

☞Subscribers not receiving their numbers regularly are requested to report the same at once to the Editor, P.O. Box 205, Montreal.

THE BLUE PROCESS OF COPYING TRACINGS, ETC.

This process is now extensively used in the drawing-rooms of a number of firms and companies, and saves not only much labor, but a great deal of weariness to the junior draftsmen to whose lot it usually falls to make copies or tracings of drawings. The *Railroad Gazette* says that in the office of Messrs. William Sellers & Co., and in the drawing-room of the Pennsylvania railroad at Altoona, all tracings, when more than one copy is required, are made by this method. It is described as follows in a short paper read by Mr. P. Barnes before the Institute of Mining Engineers:

The process is believed to be of French origin, and has been used for many years. Special attention seems to have been directed to it recently, and its great value to engineers appears likely to be fully recognized.

The manipulations required are of the simplest possible kind, and are entirely within the skill and comprehension of any office boy who can be trusted to copy a letter in an ordinary press.

These particulars my be summarized somewhat thus:

1. Provide a flat board as large as the tracing which is to be copied.

2. Lay on this board two or three thicknesses of common blanket, or its equivalent, to give a slightly yielding backing for the paper.

3. Lay on the blanket the prepared paper with the sensitive side uppermost.

4. Lay on this paper the tracing, smoothing it out as perfectly as possible so as to ensure a perfect contact with the paper.

5. Lay on the tracing a plate of clear glass, which should be heavy enough to press the tracing close down upon the paper. Ordinary plate glass of $\frac{3}{8}$" thickness is quite sufficient.

6. Expose the whole to a clear sunlight, by pushing it out on a shelf from an ordinary window, or in any other convenient way for six to ten minutes. If a clear skylight only can be had, the exposure must be continued for thirty or forty-five minutes, and under a cloudy sky, sixty to ninety minutes may be needed.

7. Remove the prepared paper and drench it freely for one or two minutes in clean water, and hang it up by one corner to dry.

Any good hard paper may be employed (from even a leaf from a press copy-book up to Bristol board) which will bear the necessary wetting.

For the sensitizing solution take $1\frac{1}{2}$ oz. citrate of iron and ammonia and 8 oz. clean water; and also, $1\frac{1}{2}$ oz. red prussiate of potash, and 8 oz. clean water: dissolve these separately and mix them, keeping the solution in a yellow glass bottle, or carefully protected from the light.

The paper may be very conveniently coated with a sponge of four inches diameter, with one flat side. The paper may be gone over once with the sponge quite moist with the solution, and a second time with the sponge squeezed very dry. The sheet should then be laid away to dry in a dark place, as in a drawer, and must be shielded from the light until it is to be used. When dry the paper is of a full yellow or bronze color; after the exposure to the light the surface becomes a darker bronze, and the lines of the tracing appear as still darker on the surface. Upon washing the paper the characteristic blue tint appears, with the lines of the tracing in vivid contrast.

It will readily be seen that the process is strictly photographic, in the ordinary sense of the word—the tracing taking the place in the printing of the ordinary glass negative. Hence all details are closely reproduced, even to the texture or threads of the tracing-cloth.

A working drawer thus made furnishes its own background, and does not require to be placed over a white ground, as is often the case with a tracing. If desired the copy can be made upon common bond paper, which can be mounted upon a board in the usual way.

Inasmuch as such copies can be made from tracings only, it may be well to suggest and urge, that drawings can be completed or nearly so in pencil upon paper in the usual way, and that all the inking can be done upon the tracing-cloth laid upon the pencil-work. In this way the cost of the tracing (in the ordinary sense) can be wholly saved, and the single copy of the finished tracing can thus be made in the "blue" way to the best possible advantage.

It may safely be said that this method of copying can be employed if only one or two copies per week are needed of ordinary complex drawings, with excellent results and with a very important saving of time and money.

A ready means of adding to or correcting the blue copies may be found in the use of a solution of carbonate of soda or potash, used with a pen or brush.

OUT-DOOR SAFETY.

The fear of the weather has sent multitudes to the grave, who otherwise might have lived in health many years longer. The fierce north wind and the furious snow-storm kill comparatively few, while hot winter rooms and crisping summer suns have countless hetacombs of human victims to attest their power. Except in localities where malignant miasms prevail, and that only in warm weather, out-door life is the healthiest and happiest, from the tropics to the poles.

The general fact speaks for itself, that persons who are out of doors most take cold least. In some parts of our country, near one-half of the adult deaths are from diseases of the air passages. These ailments arise from taking cold in some way or another; and surely the reader will take some interest in a subject, which, by at least one chance out of four, his own life may be lost.

All colds arise from one of two causes.

I. By getting cool too quick after exercise, either as to the whole body, or any part of it.

2. By being chilled, and remaining so for a long time, from want of exercise.

To avoid colds from the former, we have only to go to a fire the moment the exercises cease in the winter. If in summer, repair at once to a closed room, and there remain with the same clothing on, until cooled off.

To avoid colds from the latter cause, and these engender the most speedily fatal diseases, such as pleurisies, croup, and inflammation of the lungs, called pneumonias, we have only to compel ourselves to walk with sufficient vigor to keep off a feeling of chilliness. Attention to a precept contained in less than a dozen words, would add 20 years to the average of civilized life: keep away chilliness by exercise; and when overheated cool off slowly. Then you will never take cold in-door or out!—*Hall's Journal of Health.*

ANALYSES OF HAIR DYES.—The London *Lancet* had recently twenty-one "hair-restorers," "hair dyes," analyzed. Out of the twenty-one samples examined, no less than fourteen were practically identical in their nature. They contained sulphur in suspension, and also lead in varying, but always in very considerable quantity. Three of these preparations have American labels, the rest were English. The descriptions varied a good deal. Only one was plainly described on the label as poisonous, if taken internally, while many were described as "perfectly harmless," "free from injurious substances," and so on. The prices varied from 25 cents to $1.50 per bottle.

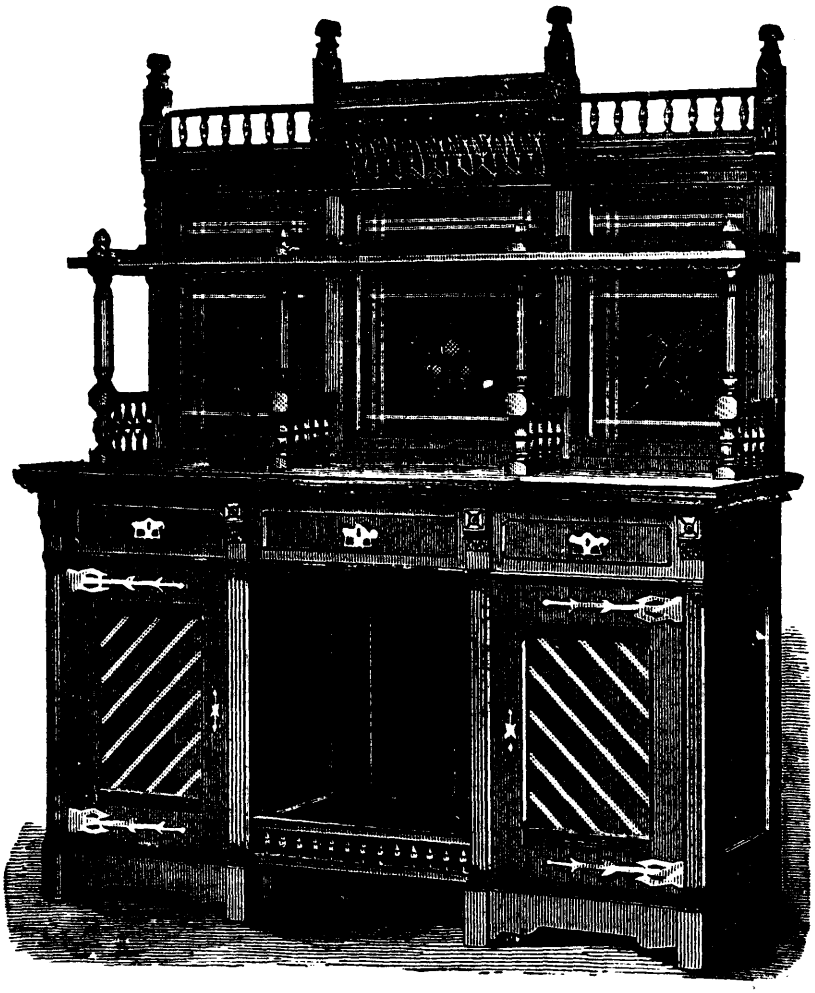
Two more samples, one of them American, were found to contain lead and sulphur, but in a different form. The sulphur was present as hyposulphite, and, in fact, these preparations may be substantially imitated by adding hyposulphite of soda to a solution of a lead salt. A white precipitate first appears, which dissolves in excess, and the solution so obtained *does not give a precipitate with iodide of potassium*. This is noteworthy, because in the handbill which accompanies one of the samples, purchasers are warned against the dangerous hair preparations which contain lead, as likely to lead to paralysis of the brain and insanity, and are directed to test all preparations with *iodide of potassium*.

In another sample, an American one, no free or loosely-combined sulphur was found, but only lead, in considerable quantity.

Another of the preparations was contained in two bottles; in one of which ammonio-nitrate of silver, and in the other pyrogallic acid was detected. This, therefore, belongs to an entirely different class from the preceding.

The remaining three preparations analyzed were intended for lightening, instead of darkening the color of the hair. No substantial difference between these samples was detected. Each was found to contain a tolerably concentrated and slightly acidulated solution of peroxide of hydrogen. It is well known that this is the active agent in preparations of this kind. It can hardly be considered as poisonous, but its action on the hair is said to be injurious.

VARNISH FOR SILVERWARE.—Gum elemi, 30 parts; white amber, 45; charcoal, 30; spirits of turpentine, 375. It must be used in a heated state, the metal to which it is to be applied being also heated.



SIDEBOARD IN THE QUEEN ANNE STYLE.

From *Bicknell's Specimen Book of 100 Architectural Designs.*

MOTHS IN FURNITURE—IMPORTANT.

Taken as a whole, throughout the country, housekeepers suffer more annoyance and destruction of furniture, carpets, and woollen garments by *Moths*, than from any other pest. The little red ant is a great nuisance in some localities, but it is not destructive and not very prevalent. Moths are universal, and whole sets of costly upholstered furniture fade away, losing their beauty and substance, even after days, weeks, and months of watching, beating, and picking, with painstaking care. Latterly, establishments have been opened in leading cities to kill moths. First it was done by removing the upholstery from the wood and thoroughly *baking* it. More recently liquid preparations have been used. But the necessity of transporting furniture to these establishments, and the large expense, have been serious obstacles. Some parties advertised to sell a moth-killing secret for a certain sum of money. We are happy in being able to announce to our readers an easy, simple process, that we have tried the past season, with what appears to be a complete success. (We mentioned it to a furniture dealer and repairer to-day, and he said he had practised it for some time, and that it was a sort of "trade secret.")

The process: A set of furniture that seemed to be alive with the larvæ, from the month it came new, and from which hundreds of these pests had been picked, and brushed, was set into a room by itself. Three gallons of benzine were purchased, at 30c. a gallon, retail. Using a small watering pot, with a fine rose sprinkler, the whole upholstery was saturated through and through with the benzine. *Result:* Every moth, larvæ, and egg was killed. The benzine dried out in a few hours, and its entire odor disappeared in three or four days. Not the slightest harm happened to the varnish, or wood, or fabrics, or hair stuffing. That was months ago and not a sign of a moth has since appeared. The carpets were also well sprinkled all round the sides of the rooms with equally good effect. To have known this two years ago, would have been worth at least $50.00 in the saving to a single set of furniture, and would have saved many days of most annoying labor. If this is not worth, to multitudes of housekeepers, many times the cost of the *Canadian Mechanics' Magazine*, we shall be greatly mistaken.—For furs, flannels, indeed all woollen articles containing moths, benzine is most valuable. Put them in a box, sprinkle them with benzine, close the box tightly, and in a day or two the pest will be exterminated and the benzine will *all* evaporate on opening.

☞CAUTION:—Benzine, in fluid or vapor form, is very inflammable; therefore, when using it, have *no* fire or burning light in the room—not even a match on the floor to be trod on. With this precaution it is safe. With the windows open its odor even will soon disappear.

The Canadian Mechanics' Magazine.

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