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# The Canadian Patent Office Record and Mechanics' Magazine

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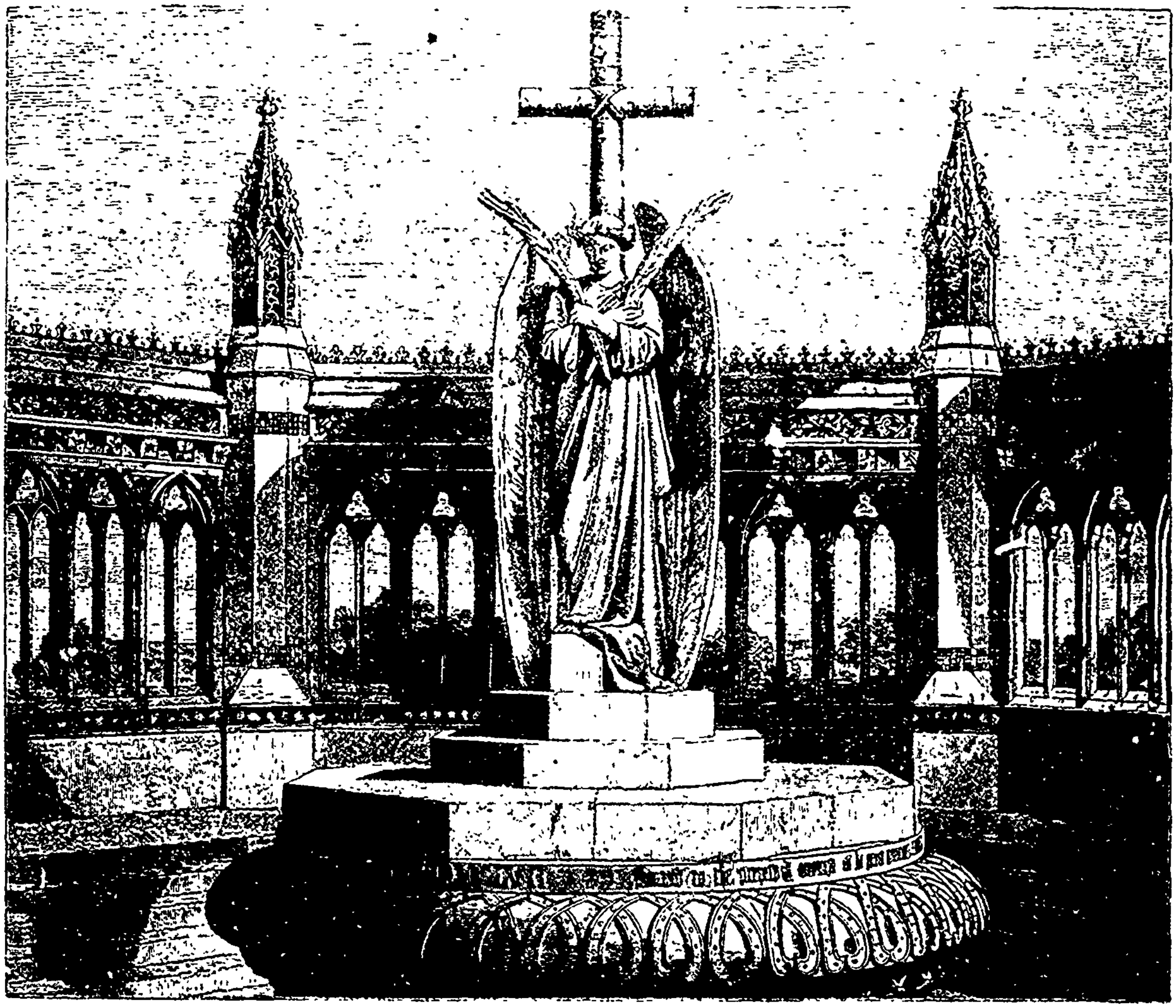


MONUMENT COMMEMORATIVE OF THE CAWNPORE MASSACRE.

## PROTECTION FOR INVENTIONS.

(Paper read before the Society of Arts.)

By F. J. Bramwell, C.E., F.R.S.

(*Continued from page 6.*)

But even if there were no objections to secret manufacture and it could be carried on without the demoralization and risks of discovery I have shown to be attendant upon the exercise of it, such a manufacture is applicable only to those cases of invention, where the improvement is in the means, or process, and not in the article produced. A textile fabric, similar in its structure and appearance to those already known, may be better because it is cheaper, having been produced in an improved loom, and dyed by dyes, the use of which was hitherto unsuspected. In such a case secret manufacture is to a certain extent practicable, because the mere appearance of the cloth does not reveal by what means it was so cheaply made. As regards the weaving, however, the difficulty of secrecy would be great, but with respect to the dyeing, concealment might be more easy if the improvement consisted in the application of an ingredient which could be added by the inventor himself, or by some one or two persons whom he might trust.

But in the large class of inventions, where the product is an improved one, and the very inspection of it reveals the improvement, secrecy is obviously impossible. Let me, as an illustration, refer you to the Giffard injector. This invention (to which I shall again have to allude) is one applicable to the supplying of steam boilers with their feed water, and replaces the steam donkey pumps formerly used for that purpose. The very first mechanical engineer into whose hands one of these injectors came would take it to pieces, and at once ascertain the nature of its construction. In such an instance as this there can be no reward by secret manufacture.

In the case I have assumed, where it may perhaps be possible for an inventor to carry on a secret manufacture, I have taken (in favour of the advocates of such a system) the instance of a man having made an invention in his own trade, and being possessed of every facility for bringing that invention to a commercial result, but I believe it is not among inventors and inventions such as these that we must look for great improvements; the fact is, that the bulk, one might almost say the whole, of real substantive inventions have been made by persons not engaged in the particular pursuit to which those inventions relate.

Take a few instances. Watt was not a maker of steam engines, the fire-engines of his day, but he was a mathematical instrument maker, Arkwright, the inventor of the "water twist," was a barber, Cartwright, the inventor of the power loom, was a parson, Neilson, the inventor of the hot blast, was wholly unconnected with smelting operations, he was the manager of a gas works, Wheatstone, who has done so much for electric telegraphs, was engaged in the manufacture of musical instruments, and Ronalds, the very originator of the electric telegraph, had nothing to do with the visual telegraphs in use in his time; Bessemer, who has so enormously increased the manufacture of steel within the last quarter of a century, was in no way connected with that industry. The fish-joint for railways, the greatest improvement in permanent way that has been made since railways were introduced, was the invention of a carriage builder. I trust I have given instances enough to establish my position, that the great substantive inventions are made by persons unconnected with the manufacture or art to which those inventions relate, and we can readily see why this should be.

The person who has been brought up to pursue any particular manufacture has even before he had sufficient knowledge to be able to appreciate the merits and the principles of the processes he was taught to follow, been trained in the belief that "certain ends are to be obtained by particular means."

Under such circumstances, it is difficult for even a powerful mind to break through the trammels which have been imposed upon it, and to approach the consideration of the subject of the particular art with the same broadness of view, and power of detecting and grasping the true principles upon which that art is based, as would be possessed by a mind devoting itself to the subject for the first time, and thus the man untaught and unprejudiced in the art is more likely to make substantive invention than is one who has been trained in it from his youth.

Improvements of detail such a person may make, but there, in all probability, will be the limit of his inventions.

One can understand that a man who had been taught from his boyhood to make steel by the process of cementation, that is by packing bars of wrought iron into brick boxes containing charcoal, and exposing the whole for several days to considerable heat, and thus carbonising the iron and producing blistered steel, might, not unnaturally, devise some improvement by which this process could be expedited, though one can hardly imagine such a man breaking with the traditions of the industry, and casting away the whole process of cementation. But one bringing a totally fresh mind to the consideration of steel manufacture would, in all probability, study the question from the very beginning, and would say, "What is steel? What is wrought iron? What is cast iron?" and when he discovered that steel was something between cast iron and wrought, that is to say, it contained less carbon than the one, and more than the other, and when he found that cast iron was a cheaper article than wrought iron (wrought iron being commonly produced from cast by practically abstracting the whole of its carbon), would seek a means by which he might abstract from cast iron, not the whole of the carbon, to leave wrought iron, but so much of the carbon as would leave steel.

To one brought up in the steel trade, the very word "steel" would be associated with the addition of carbon, and it would be most unlikely that he should attempt the manufacture by a process which had for its object the taking away of carbon.

Once concede that the great inventions are made by "outsiders," then it appears to me that to continue this, the highest class of invention, protection is an absolute necessity. An inventor must nearly in every case make trials and experiments, and these, as a rule, can only be conveniently done in places where the manufacture is being exercised; but now we are assuming that the inventor is not engaged in the manufacture, he has, therefore, either to incur great expense to make his experiments, an expense in many cases prohibitory, or to forego the experiments altogether, or else he must seek the aid, and trust to the honour of, some manufacturer.

Imagine a country clergyman who has a knowledge of chemistry making an invention of an improvement in smelting iron ore. If he were a man of real ability, as I have supposed, he would appreciate the great complexity, and the many practical difficulties, of that process, and he would know that nothing short of a trial of this invention in the actual furnace could assure him that his method would not be frustrated by some such difficulty.

What, without a patent law, is that inventor to do? Forego the trial? Devote £5,000 of the large property which usually belongs to a country clergyman, to the erection of an experimental blast furnace, trust to the honour of a manufacturer, or give up the invention? I think the probability is, he would pursue the last course, and that thus the invention would be lost to the community.

But even supposing the preliminary difficulty of a practical trial not to exist. Assume for example that the invention be one such as that of the Giffard injector, already mentioned, one of the most substantive of the present day. This might have been tried in private by its inventor without insuperable difficulty, even although he were wholly unconnected with any of the mechanical arts, and he might have perfected his invention in every detail. But when he had done this, what would have been his chance of reward, how would he have set about reaping the pecuniary benefit which he would desire, and which would be his reasonable due? Would he make up his mind to forego all his usual habits of life and to become a manufacturer?

Say that he did so, and that in spite of the difficulties to which I shall have to revert, he succeeded in making a certain number of the injectors for sale, and that then he knew enough of business to obtain purchasers for them, what would be the inevitable result? As I have already said, when taking the instance of this implement as one impossible to make the subject of a secret manufacture, the very first mechanical engineer (a steam pump-maker) into whose hands one of these injectors fell, would say, "Here is an implement that appears likely to compete seriously with the use of steam-pumps. Why should not I make it? At present I know it is being manufactured by the inventor only, a person who was not brought up to trade, and who is living in a purely ag icultural district · it is a hard case if I cannot hold my own against him."

Thereupon the steam-pump maker goes to work, with all the advantages of an established factory. with its befitting plant, its staff of superintendents, its foremen, and its body of workmen to produce injectors, and with a whole system of travellers and agents, and the advantage of a large connexion, to dispose of the injectors when made.

What chance would the inventor have, in his capacity of manufacturer and seller, against such an organization as this? obviously none, therefore, as it seems to me (equally obviously), he (foreseeing this) would not have bestowed the thought necessary to invent and even if he had, he would not have incurred the labour and expense of experimenting upon his invention.

Having shown (as I trust I have) that in those cases where the invention is one that could be exercised by the inventor, his chance of profit in the majority of instances would be but small, even if he could carry on a secret manufacture, it is almost surplusage to show, as I am about to do, that there are numerous instances in which (whatever might be the position of the inventor, as regards command of capital, business habits, and residence in an appropriate locality) it would be impossible from the very nature of things for him to reap an adequate reward.

Take the case, again, of the fish-joint on railways. This great improvement requires for its carrying out, at each joint only two bars of iron and four bolts and nuts These can be produced at every iron works in the world, without the exercise of any unusual skill or intelligence; they are mere common articles of manufacture, yet, when applied to rails in the way directed by the inventor (a way which after years of study of the question of how to improve the admittedly defective railway joints no engineer ever thought of), it makes a joint which has added to the life of permanent way and of rolling stock, and has contributed in a great degree to the comfort of the traveller.

Take an instance of another kind, one wherein the invention does not consist in a simple "application" of a common article of commerce, but in a "process," say the Bessemer steel manufacture Notwithstanding the trammels of a patent law (as the opponents of such laws would say, or rather aided by the provisions of such a law, as I should say) the Bessemer invention in 1873 produced, in England alone, 400,000 tons of steel, while in 1851 the total production of cast steel was but 30,000 tons It seems to me fitting that one who has so far benefitted manufacture and commerce should have a large reward

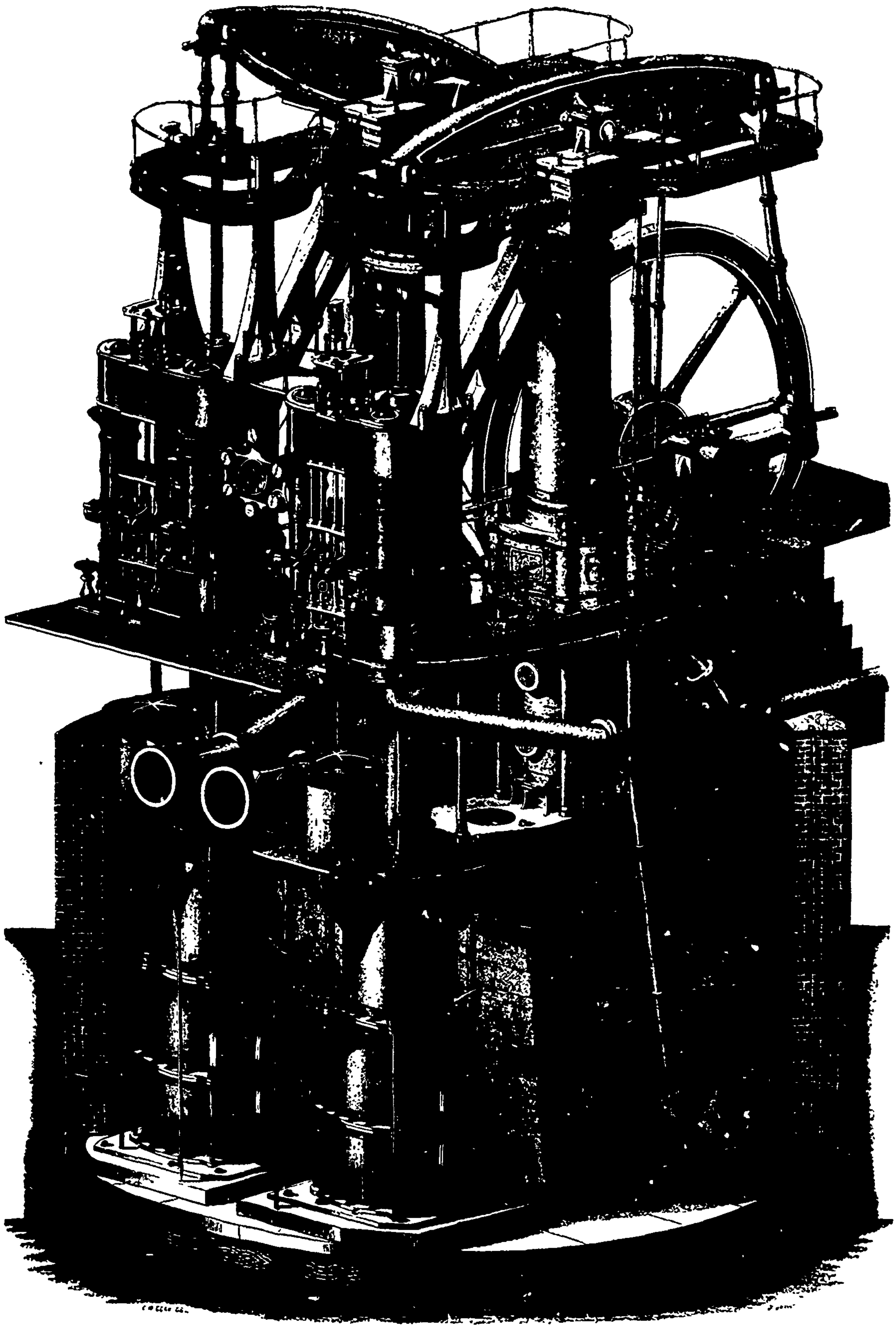
By the aid of a royalty it was possible for Bessemer to obtain, by a small percentage on the price of all steel, a substantial reward but I do not see how this could have been secured to him by the profits derived from being himself the manufacturer of that which, even on the largest development of his works, could only have been a small fraction of the whole. The very magnitude of the results of his invention would be a bar to an adequate reward, unless the reward were spread over the whole manufacture

There is one other class of inventions, the nature of which renders it impossible for the patentee to be adequately rewarded (even under the most favourable circumstances) by manufacture I will instance the regenerative furnace of Dr. Siemens This furnace of which there is a diagram on the wall, has for its object the saving of fuel and the attaining of high heat Laudable objects these Let us see how Dr. Siemens attains them He makes a large chamber, called the "Producer," capable of holding, say 3 or 4 tons of coal or coke. At the bottom of this chamber there is a small fire-grate, immediately above which a portion of the fuel is undergoing combustion in the ordinary manner The heated carbonic acid resulting passes up through the fuel, takes up carbon from it, becomes converted into carbonic oxide, and escapes (with any hydro-carbon that may have been driven off by the heat if the fuel be coal) through an ascending pipe, and is led away by mains to any place where a regenerative furnace is to be in operation The regenerative furnace is to be in operation. The regenerative furnace has below it two pairs of stacks of cellular, or pigeon-hole, brickwork Through one division of one pair the gas from the producer is ascending, through the other division of the same pair atmospheric air is also ascending; the air and gas meet in the chamber of the furnace, combustion ensues, and heat is developed. In an ordinary furnace the heated products of combustion escape into the air by a chimney, and, as they must leave the furnace at a higher temperature than that at which it is necessary to maintain the material under operation (or otherwise they would cool that material), the products of combustion of ordinary furnaces must in all cases where high temperatures are necessary, carry into the air, and waste a large amount of heat. But in the Siemens' furnace these outgoing products are compelled, on their way to the chimney, to pass downwards through the two divisions of the second pair of blocks of pigeon-hole brickwork, and in their passage they give up their heat to this brickwork so effectually that, although they may have been issuing from a furnace above the temperature of melted steel, they will, on reaching the chimney, not have heat enough remaining in them to char a piece of wood. At the end of a certain time, say half or three-quarters of an hour, valves, which control the direction of the currents of gas and air, and of the outgoing products of combustion, are shifted, and the gas and air are now caused to ascend through the pair of masses of cellular brickwork which have just been heated by the outgoing products of combustion, while those products are directed downwards through the other pair of cellular structures, which have been cooled by the passage through them of the gas and air. and thus are fit, being cool, to take out from the products of combustion the heat which is in them, and to store it to heat up the gas and air, when they, on the next reversal of the valves, again pass through them.

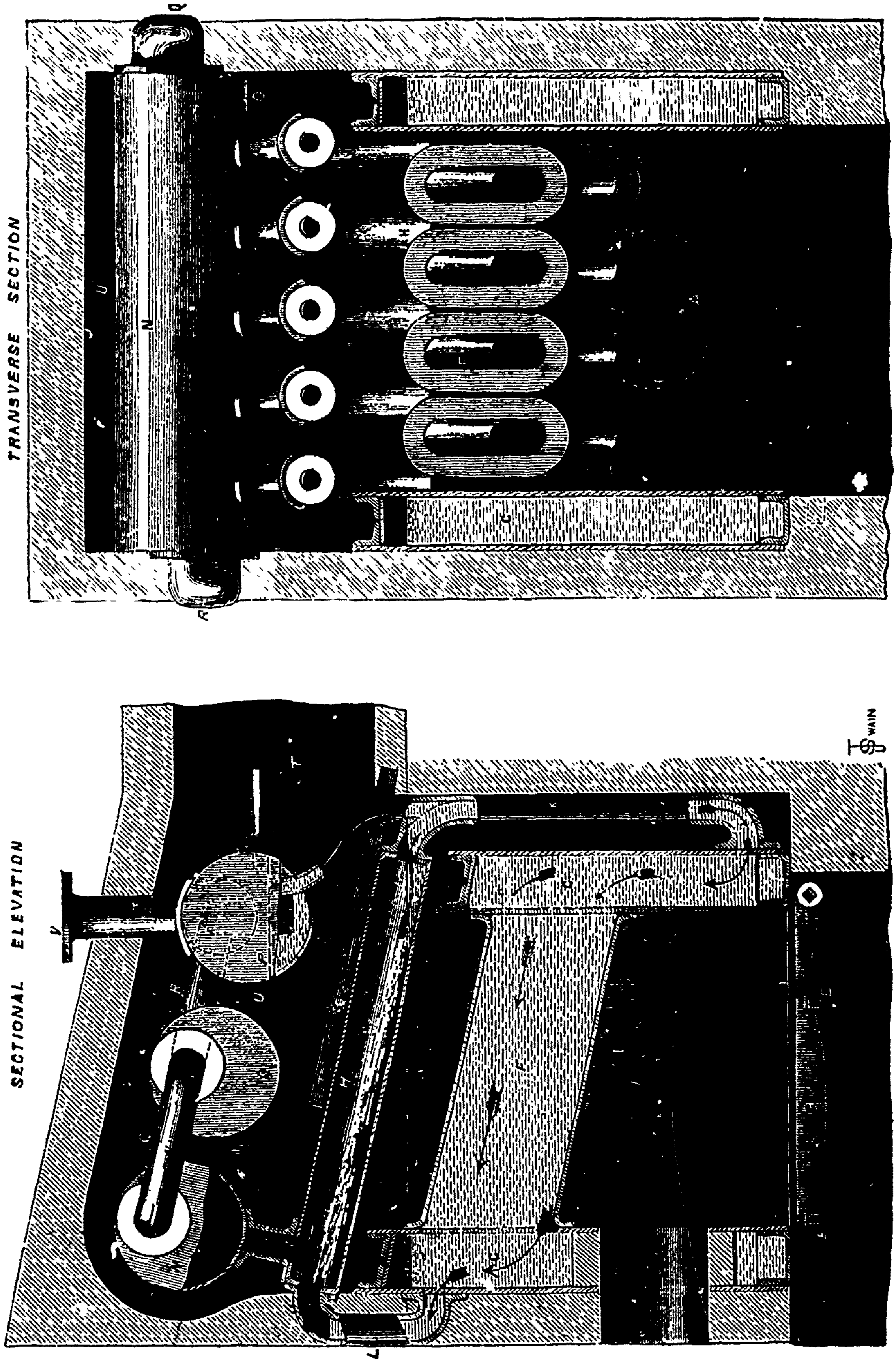
The success of this plan has been complete; the advantages in economy of fuel, and in the capacity to give high heat, have been all that could be desired. Moreover, there are large contingent benefits, into which I will not now enter. No one will dispute that this is a most meritorious invention; it saves our coal, and it renders possible certain processes, which, with the temperatures formerly attainable, could not be carried out. But how, in the absence of protection for invention, could Dr. Siemens have derived any adequate reward? Not by practising his invention, for that, from the very universality of its application, would have been an impossibility. His furnaces are used by the manufacturers of wrought iron, by the makers of steel, by the producers of plate and flint glass, by enamellers, by copper smelters, by nail makers, potters, and by those engaged in numerous other branches of industry requiring furnace power.

I should like to ask the advocates of the system of rewarding inventors, by letting them carry out, as manufacturers, the objects of their invention, whether they would suggest that Dr. Siemens was to embark in all the businesses to which his invention is applicable. They might say, "No; we never intended anything so absurd. His invention is a furnace, and he should embark in the manufacture of furnaces, as the inventor of an improved loom should embark in the manufacture of looms." But the answer to this would be, a loom is a self-contained machine, capable of being manufactured in one place and conveyed for sale to another, and is an ordinary article of commerce, but the Siemens furnace is not self-contained- it is not portable. The furnace demands nothing more for its construction than the employment of ordinary materials set in a particular way, the way of the invention, and any intelligent furnace builder, to whom a drawing of the invention is shown, or who has seen one furnace, could carry out the invention.

I will now consider another class of cases, those cases where the inventors are poor men, and where, therefore, it must be admitted that whatever advantage they may have of locality, or even of business habits, they lack the greatest of all aids to prosperous manufacture—capital. How can these men, by becoming manufacturers of that which is the subject of their invention, obtain a fair reward for their ingenuity? It is said by the opponents of a patent law, let such men go to capitalists, explain their invention, and thus obtain the aid that wealthy men can give. What would be the result? The capitalist would say, Why should I embark my money in perfecting an invention, and putting up suitable machinery for its manufacture, with the certainty that if it turns out a success I shall have the whole trade in competition with me, and competing on better terms than those under which I should be working, because they would stand by to watch my results, and would wait until I mastered all difficulties? You are asking me to run a special risk to reap (even if successful) no more than the reward of ordinary manufacture. Moreover, I don't wish



PUMPING ENGINES AT THE CHICAGO WATER-WORKS.




POPE'S SECTIONAL BOILER.

to trammel myself by associating with you in business, and I cannot pay you a sum of money, because I have no security that you will not go and resell your invention to others.

But suppose the invention were one that afforded reasonable grounds for believing that it might be carried on by secret manufacture, that the inventor were to point this out to the capitalist, and that he were inclined to embark in that most unsatisfactory kind of business. What security has the inventor that after he has communicated his secret to the capitalist, the latter will not abuse the confidence that has been reposed in him, and either take the invention without any reward, or with only a very inadequate reward? A man can often contrive to act in such a manner without wounding his conscience. He goes to his foreman, or he consults a friend, and these tell him, "Oh, there is really nothing new in this; twenty years ago the same idea (I do not mean you know to every detail, but practically the same idea) occurred to me, and I should have carried it out, only the condition of the trade at that time did not warrant my going into fresh expenses; there really is nothing in this except the bare detail, beyond what we knew before," and so the inventor is shown to the door, and the confidential communication is abused.

I may be asked why are you to suppose knavery of this kind; why not assume that the majority of mankind are not only honest in the legal sense, but that they have a feeling of honour which would not permit them to act as you have suggested? What warrant have you for believing that inventors might not trust others with their secrets? Again, I refer you to the life of Crompton. After the trade had (as I have told you) laid siege to his house, and kept him there barricaded, and all but a prisoner, he was so wearied out that he proposed terms to his persecutors. He would reveal his secret to them if they would undertake to pay him a certain sum of money on his doing so. Many "honourable men" agreed, in writing, to pay him the sum set against their respective names, sums varying from one guinea to five shillings, and making the magnificent total of £106. Crompton kept his part of the bargain, he met his honourable fellow townsmen, showed them the machinery, explained everything, and what happened? Out of the number who had made this bargain with him, many never paid one farthing, but, furnished with the information, at once went to work in competition with Crompton, and (after having broken the eighth commandment by stealing his invention) proceeded (as I have told you already) to break the tenth by coveting their neighbour's servants; and as is usual they did not stop at coveting, but they enticed them away, and they made their temptation so strong that even Crompton's own sons deserted him and went to his opponents.

How different is the condition of the poor (comparatively poor) inventor who avails himself of our patent law. For a few pounds he can get provisional protection, and, the moment he has it, he has possession of property which the law secures to him, as effectually as it secures the enjoyment of house or land. Armed with this right, he can go to the capitalist, not only without fear that his confidence will be abused, but with a strong inducement to the capitalist to advance his aid. There is no longer a dread that when all the expense has been incurred to perfect the invention, and to bring it into actual use, the benefit will be reaped by others without special reward to those who between them have made the invention, and have risked the money to work it, and thus it is that we find inventors aided, as Boulton aided Watt, and from such aid the happiest results flow.

I remember that a gentleman who had made a most meritorious chemical invention, by which a substance that had always been considered as nothing but a waste product of the most offensive kind became converted into a highly valuable article of commerce, stated before Section F of the British Association at Exeter, that he had required an outlay of £10,000 in order to test by actual trial whether or not his invention, successful as it was in the laboratory, would be equally so in actual work. He added that he was as unable to find £10.000 from his own resources as he was to pay off the National Debt, but he was able to find money enough to obtain the protection of the law for his invention, and having got this he submitted his plans to a capitalist. He advised that capitalist to call in the highest chemical assistance, for the inventor, protected by his patent, no longer required secrecy, on the contrary he courted the fullest investigation. The chemists examined, they reported favourably, the money was advanced; the whole thing was a success; and now, added the speaker, I find myself a comparatively rich man, and have beside the satisfaction of knowing that I have caused one of our manufactures to make a most important step.

*(To be continued.)*

## PUMPING ENGINES AT CHICAGO.

We publish on page 68 an engraving of a pair of pumping engines erected the year before last at the Chicago Water Works. As will be seen from our illustration the engines are of the beam type, and are coupled, the cranks being at right angles. The steam cylinders, which are 70 in. in diameter with 10ft. stroke, are fixed upon the upper bedplate, which is supported by four 9in. columns springing from the lower bedplate. The steam and exhaust valves are of the double-beat equilibrium type, and are actuated by the valve gear known as the "Sickle's cut-off." The side pipes and all other parts of the "fronts" are polished, and the cylinder lagging is cased with black walnut, with a heavy brass moulding at top and bottom. Between the side pipes of the cylinders is fixed a cast-iron frame on which the steam and vacuum gauges, as well as a clock and revolutions counter, are neatly arranged.

The crossheads are guided by slides fixed to the cylinder covers, and attached at their upper ends to the entablature, there being no parallel motion. The main columns which support the main centres are 24 ft. 7½ in. high from the base of the pedestal to the top of the cap, and weigh 17 tons each. The pedestal is 6 ft. 4 in. in diameter. The main shaft of each of these columns serves as an air vessel, being connected to the check-valve chamber by a 30 in. main, while the lower sections of the columns, beneath the engine room floor, and between the upper and lower bedplates, form the condensers.

The upper bedplate of each engine is 36 ft. 3½ in. long, 9 ft 6 in. wide at the cylinder end, 7 ft. 10½ in wide at the crank end, and 3 in. thick. These plates are heavily bracketted, and each weighs 19 tons. At the cylinder ends these plates rest, as we have said, on cast-iron columns, while at the crank end they bear directly on stone foundations. The lower bedplates are each 29 ft. 7½ in. long, 7 ft 6 in. wide at the pump end, and 7 ft. at other end. The weight of each is 18 tons. The plates are fitted to a stone foundation throughout their length. The upper and lower plates are secured to the foundations by 62 bolts from 2 in. to 3 in. in diameter, and ranging from 6 ft. 6 in. to 30 ft. in length.

The beams are of cast iron and are 28 ft. long between end centres, 6 ft. deep in the middle, and 2ft deep at the ends. They have webs 3½ in. thick, with heavy top and bottom flanges, and weigh about 20 tons each. The connecting rods, cranks, and crankshaft are of wrought iron and got up bright. The flywheel is 25 ft. in diameter, and has eight arms and a rim 20 in. deep and 12 in. wide on the face. The weight of the wheel is 33 tons, and the rim is turned and polished.

The air pump of each engine is worked from a point in the beam between the main centre and the point of attachment of the connecting rod. It is single acting, 45 in. in diameter and 4 ft. 6 in. stroke. The valves are of indiarubber working on brass seats. The condenser is as we have said formed by the lower section of the main column.

The main water pumps are situated directly beneath the steam cylinders and are of a modified bucket and plunger type. Each pump is 57 in. in diameter, with, of course the same stroke as the steam pistons, namely, 10 ft., and each has a plunger 40 in. in diameter, this plunger being connected to the steam piston by a 7½ in. piston rod. Instead, however, of the discharge of the water taking place through the bucket and plunger pump, it takes place through an annular chamber which surrounds the pump barrel, the delivery valves, twelve in number, being fitted in this chamber. The suction valves, fifteen in number, are fitted to a diaphragm plate directly below the pump barrels. All the valves are of gun-metal, and are of the double-beat type and 15 in. in diameter. The pumps are situated below the surface of the water in the well, and the annular chamber, which we have mentioned as forming the delivery passage, is provided with a branch leading to a check-valve chamber containing a cast-iron double-beat check valve 36 in. in diameter. To the check-valve chambers the 36 in mains leading to the city are connected.

The engines are supplied with steam by three boilers each 20 ft. long by 12 ft. in diameter, these boilers, notwithstanding their large diameter, being made of only $\frac{3}{8}$ in and $\frac{1}{2}$ in plate. The boilers are traversed by six flues and sixty-five $5\frac{1}{2}$ in. tubes. We hope, hereafter, to be able to lay full particulars of these boilers before our readers.

The engines we have described are run at an average speed of eight revolutions per minute, and they have, we believe, given every satisfaction. They were erected under the direction of Mr Dewitt C Cregier, the mechanical engineer to the Chicago Water Works; the engineer to the city of Chicago, under whom the water works generally, and other public works connected with Chicago, have been ably carried out, being Mr. E. S. Chesborough.—*Engineering*.

## POPE'S SECTIONAL BOILERS.

The sectional boiler which we illustrate at page 69 possesses peculiar interest, from the fact that it worked successfully for a period of thirteen years before it was worn out—a duty, never, so far as we know, performed by any other sectional boiler. When it ultimately failed, after a life of constant service, the ends of the superheating chambers were the defective members. They were much corroded, probably by being close to the brickwork, and the boiler was removed only because it was desirable that it should be replaced by one more powerful. The boiler was worked with London water, and was never cleaned out in thirteen years, nor was it dirty when it was finally cut up. It was blown off freely twice a day, and every now and then Mr Pope, the inventor, pumped in about five fluid ounces of hydrochloric acid with the feed-water. The boiler was employed at Mr. Pope's works in the Edgware-road.

The construction of the boiler will be readily understood; steam is generated in flat chambers of wrought iron, disposed as shown. These chambers are 4 in. wide, and from this the remaining dimensions of the boiler may be gathered. To prevent the chambers from bursting, flat pieces of iron were interposed between them, and the whole tied together by a strong frame and cross-bars of wrought iron. To use Mr. Pope's own words, he designed the boiler to prime as much as possible, the water carried up with the steam rushing into the first receiver or superheater, and finally descending the back by a pipe out of the reach of the fire. The steam passed backwards and forwards through the superheaters, and when the fire was hard pushed it was sometimes raised with 80 lb. presure to 600 deg. Fah. but the degree of superheat was very ingeniously determined by making one of the steam.pipes dip more or less below the surface of the feed-water coming in at the top, by which the steam was cooled and moistened as required.

The following description, extracted from Mr. Pope's patent, will make the construction of this remarkable boiler clear:—"G G, body of boiler, F, a series of cross chambers with flue spaces between each, having connections at each end with shell of boiler G G; H, a series of inclined tubes over flue spaces between F F, L are circulating pipes from lower chamber of boiler to upper tubes H, K is the return circulating pipe for surplus water connected into bottom of boiler G; M is a deflecting nozzle in mouth of pipe L, J, series of small short pipes connecting tubes H with steam chamber N; O and P, two other steam chambers connected at opposite ends by pipes Q and R, V, outlet for steam; S, fire-brick top over pipes A, U, flue spaces, T, opening into chimney, B, fire-door C, bars; D short fire-bars turning on c . W, for removal of clinker from fire; E, bearer bars for fire-bars. The action of the boiler is as follows.—Fire being placed in fire-box A on bars C and D, and ascending through flue spaces between F F, enveloping chambers F in flame, and flame impinging on tubes H and filling the whole of the chamber U, U, U, U, in which space are three steam chambers N, O, P, the heated gases proceeding from chamber to chimney T, the action of the fire immediately causes a very rapid circulation in F and G. The steam and water are driven with great force through openings in front plate of G, which are situated below water level of boiler through pipe L, and delivered on to the highly heated inclined surface of tubes H, the water becoming rapidly vaporised, surplus water flowing down the inclined tube H through pipe K to bottom of boiler, thereby maintaining the circulation, the steam generated in H passing away through the pipes J into steam chambers N, O, P, and in its passage travelling their whole length forward and backwards to the outlet V; the chambers being at a very elevated temperature, deliver the steam at V in a very superheated state. The chamber P may be partly filled with water, as shown, and the end of pipe R dipped below its surface, causing the superheated steam to pass through the water, taking up the quantity of water due to its temperature in its passage to V. The feed-water may be taken into this chamber with an overflow pipe conveying it to bottom of boiler."

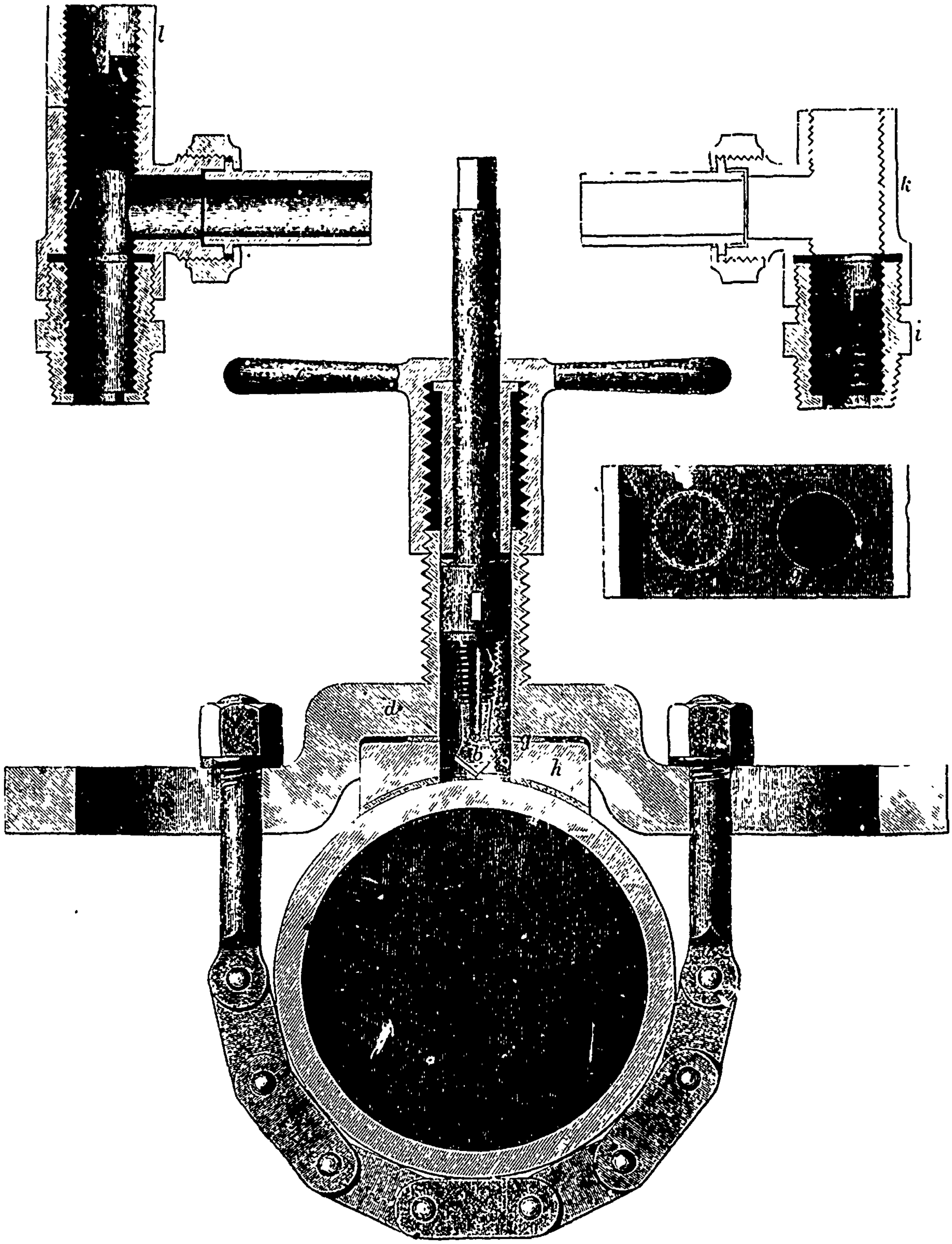
There is good hope for the future of sectional boilers, with Mr Pope's experience before us, and the success which has attended his exertions in this path of engineering is the best possible answer to the objections which may be urged against his system of construction.—*The Engineer*.

## MORRIS'S PATENT STOP-VALVE SCREW FERRULE

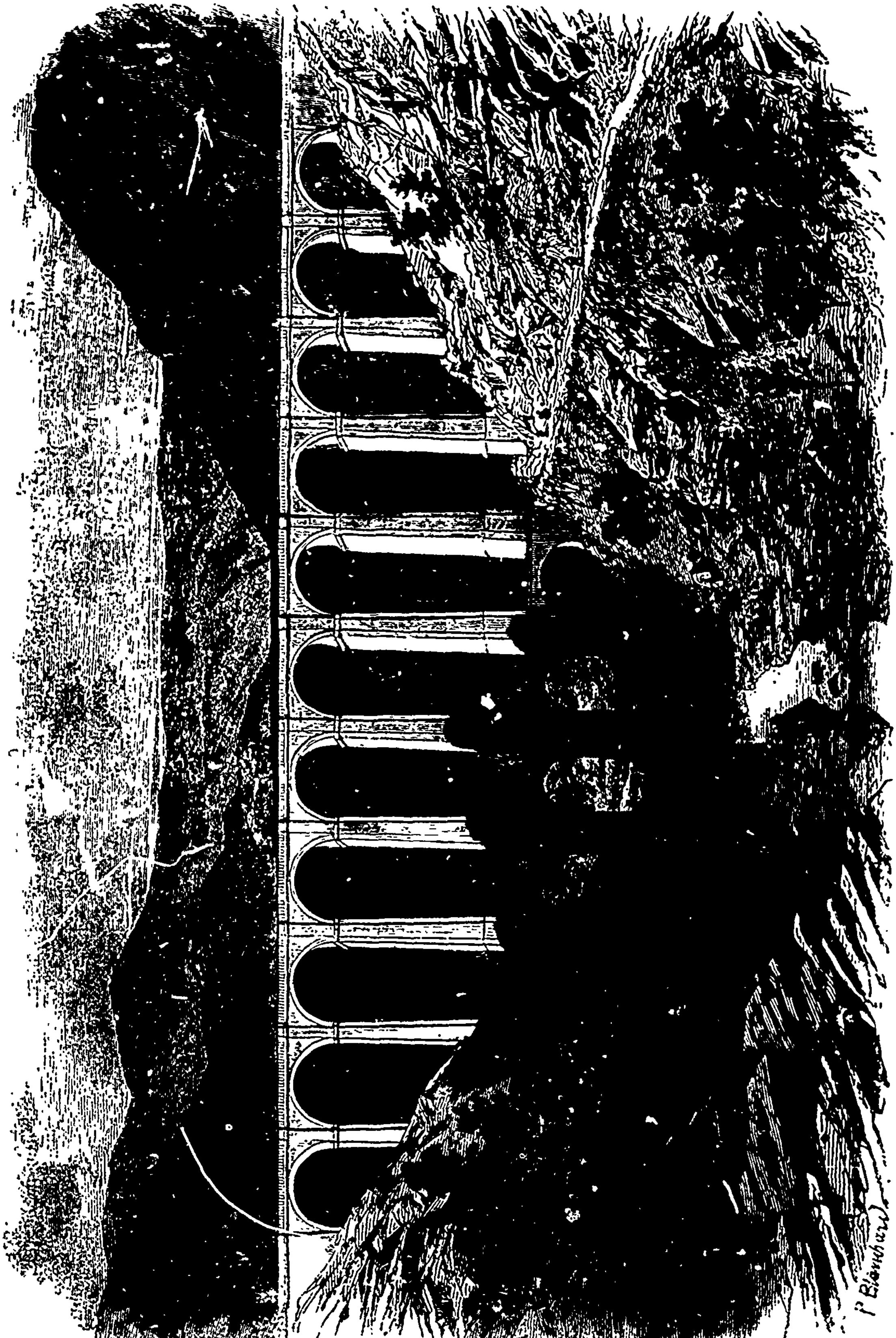
This ingenious invention renders it perfectly easy and safe to make a connection to any gas or water main, while under pressure, with the certainty that no leakage or waste will take place. One of its principal features is the introduction into the ferrule of an internal screwed plug actuated from the top of same, the object of which is to close the communication between the inlet and outlet of the ferrule while it is being attached to the main, to do which the internal plug is screwed down tight on to a seating in the lower part of the ferrule. When the ferrule is fixed to the main and connections attached, the internal plug is screwed back, which draws it up into the head or top of the ferrule, which it effectually closes, and at the same time opens up a free communication between the inlet and outlet of ferrule, thus allowing the gas or water to pass into the service pipes.

The drilling and tapping apparatus—shown in the illustration—to be used in connection with the patent ferrules is of the simplest kind. The saddle piece *d* is made so as to be used with different saddle packing pieces *h*, made suitable for different diameters of main pipe, so that one saddle piece can be used with various sizes of main pipe by changing the packing piece *h* at its underside.

The following description of the mode in which the apparatus is to be used will be readily understood:—To drill and tap the hole in a main the packing piece *h* is first placed on the pipe over the point where the hole is required to be made, the joint between it and the pipe being kept sound by means of greased felt or other suitable material: the saddle piece *d* is then fixed by means of the chain *f*; the spindle *a*, with the drill and tap *b* at its lower end, is inserted in the top of the saddle piece, and the socket *e* having a leather washer at its lower end to prevent leakage, together with the horned nut *c*, are placed in position as shown. The hole is then, by means of a cross handle fitted on the spindle, drilled and tapped in the ordinary way, after which the drill and tap are drawn up and the slide *g* moved over the hole in packing piece *h*, thus preventing the escape of gas or water, when the spindle *a* and the drill and tap *b* are removed, which is next done. The lower part of patent ferrule *i*, containing the internal screwed plug, is then inserted into the saddle piece immediately over the slide which covers the hole just made. Another spindle similar to *a*, but with a screw-driver point, is then introduced, and the horned nut *c* screwed up tight again, after which the slide *g* is withdrawn from covering the hole, and the lower part of the ferrule screwed into the orifice drilled and tapped for its reception by means of the spindle with a screw-driver point above referred to. When this is done, the whole of the apparatus is removed leaving only the lower part of the patent ferrule containing the internal screwed plug in the main pipe, the body piece *k* is then screwed on the ferrule, and the branch, or service pipe, is connected to same by an ordinary screwed union, or other joint, after which the internal plug is unscrewed by an ordinary screw-driver inserted into the top of the ferrule. As the plug is unscrewed from the lower part of the ferrule, its upper end enters and screws into the upper end of the body part *k*, thereby closing the same, and at the same time opening a free communication between the inlet and outlet of the ferrule. An ordinary iron socket *l* is then screwed on to the portion of the plug left projecting above the body of the ferrule, and a permanent joint made with white lead. The plug may be screwed back again into the ferrule, and the gas or water supply thereby shut off at any time by an ordinary screw-driver.




MORRIS'S PATENT STOP-VALVE SCREW FERRULE.




VIADUCT OVER THE ..LIER, FRANCE.

## PRINCIPLES OF SHOP MANIPULATION FOR ENGINEERING APPRENTICES.

By J. Richards, London.

*(Continued from page 231, vol. II.)*

MECHANICAL DRAWING—*(continued)*

Penciling is the first and the most important operation in drawing; it requires more skill to produce neat pencil work than to "ink in" the lines after the penciling is done. The beginner, unless he exercises the greatest care in penciling a drawing, will have the disappointment to find the paper soon becoming dirty from plumbago, and the pencil lines crossing each other at all angles, so as to give the whole a slovenly appearance. He will also, unless he stops to consider the nature of the operation in which he is engaged, make the mistake of regarding the pencil work as a preliminary part instead of constituting, as it does, the main drawing, and will thereby neglect that accuracy which is so essential.

The pencil work is indeed the main operation, the inking being merely to give distinctness and permanency to the lines. The main thing in penciling is accuracy of dimensions and stopping the lines where they should terminate, without crossing others The best pencils only are suitable for drawing; if the plumbago is not of the best quality, the points require to be continually sharpened, and the pencil is worn away at a rate that more than makes up the difference in cost between fine and cheap pencils, to say nothing of the effect upon the drawing. It is common to use a flat point for drawing pencils, but a round one will be found quite as good if the pencils are fine, and quite a convenience is gained by a round point for free hand use in making short rounds and fillets. A pencil by Faber that has detachable points, which can be set out as they are worn away, is convenient for drawing. For compasses the lead points should be cylindrical, and fit into a metal sheath without paper packing or other contrivance to hold them, and if an apprentice has instruments that are not arranged in this manner, he should have them changed at once, both for convenience and economy.

The ink used in drawing should always be the best that can be procured; without good ink the draughtsman is continually annoyed by the imperfect working of pens, and the washing of the lines if there is shading to be done. The quality of ink can only be determined by experiment, the perfume that it contains, or tin foil wrappers and Chinese labels, are no indication of quality, not even the price, unless it be with some first-class houses. To prepare the ink, I can recommend no better plan of learning than to ask some one who understands the matter. It is better to waste a little time in grinding than to be at a continual trouble with pens, which will occur if the ink is ground too rapidly or on a rough surface.

To test ink, draw lines on the margin of the sheet, note the colour, how the ink flows from the pen; after the lines have dried, cross them with a wet brush. If they wash readily the ink is too soft; if they for a time resist the water and then wash tardily, the ink is good. It cannot be expected that inks soluble in water can permanently resist its action after drying; in fact, it is not desirable that drawing ink should do so, for in shading the outlines should be blended into the tints where the latter are deep, and this can only be effected by washing. Pens fill themselves by capillary attraction if they are first made moist by being dipped into water; they should not be put into the mouth to wet them, as there is danger of poison from fancy inks, and the habit is not a neat one.

In drawing lines keep the pen nearly vertical, leaning just enough to prevent it from catching on the paper. Beginners have a tendency to holds pens at an angle, and drag them on their side, but this will not produce clean sharp lines, nor allow the lines to be made near enough to the square blades or set squares.

In regard to the use of the T-square and set squares, I can give no rule except to observe others, and experiment until convenient customs are attained. A beginner should be careful of contracting unusual habits, and, above all things, of making important discoveries as to new plans of using instruments, or that common practice is all wrong, and that it is left for him to develop the true and proper way of drawing. This is a kind of discovery which is very apt to intrude itself at the beginning of an apprentice's course in many things besides drawing, and often leads him to do and say that which he will afterwards wish to recall. It is generally a safe rule to assume that any custom long and uniformly followed by intelligent people, is very apt to be right; and, in the absence of that experimental knowledge that alone enables us to judge, it is safe to receive such customs, at least for a time, as being correct.

Without any wish to discourage the ambition of the apprentice, which always inspires him to laudable exertion, I nevertheless think it best to caution him against innovations The estimate formed of our abilities is very apt to be inversely as our experience, and old engineers are not nearly so confident in their deductions and plans as beginners are.

A drawing being inked-in, we come next to dimension and centre lines. The centre lines should be in red ink, and pass through all points of the drawing that have an axial centre, or where the work is similar and balanced on each side of the line. This rule is a little obscure, but will be best understood if studied in connexion with a drawing, and perhaps as well remembered without further explanation.

Dimension lines should be in blue, but may be in red. How and where to put them is a great point in drawing To know where to put dimensions must involve a knowledge of fitting and pattern making, and cannot be explained here; make faint lines, leaving a space in their centre for figures, when long enough. Study the distribution of centre lines and dimensions over the drawing, for the double purpose of giving it a good appearance and to avoid confusion. Learn to make figures like printed numerals; they are much better understood by the workman, look more artistic, and when learned take but little if any more time than plain figures. If the scale is feet and inches, write dimensions to three feet in inches, and above this in feet and inches; this corresponds to shop custom, and is more comprehensive to the workman, however wrong it may be according to other standards

In sketches and drawings made by the apprentice, such as are not intended for the shop, it is suggested that metrical scales be used, because such scales will not interfere with feet and inches, and it will prepare the mind for the introduction of this system of lineal measurement, which is quite sure in time to be adopted in England and America, as it has been in many other countries

In shading drawings, be careful to put on little enough, and to put it in the right place; many will contend, and not without good reasons, that working drawings need no shading; yet it will do no harm to learn how and where they can be shaded: it is better to omit the shading from choice than from necessity. Sections must, of course, be coloured—not with lines, although I fear to attack so old a custom, yet it is certainly a tedious and useless one; sections with light ink shading of different colours, to indicate the kind of material, are easier to make and look much better. By the judicious arrangement of a drawing, a large share of it may be in section, which, in almost every case, is the best kind of view to work by. The proper colouring of these sections gives a good appearance to the drawing, and conveys the idea of an organised machine, or, to use the shop term, "it stands out from the paper." In colouring sections, leave a margin of white between the tints and the lines on the upper and left-hand sides of the section; it breaks the connexion and sameness, and the effect is striking; it separates the parts, and adds greatly to the clearness and general appearance of the drawing.

Cylindrical parts in the plane of sections, such as shafts and bolts, should be drawn full and have a "round shade," which, with blue tint, relieves the sameness of appearance, a point to be avoided in sectional views Conventional custom has assigned blue as the tint for wrought iron, neutral or pale pink for cast iron, and purple for steel. Wood is generally distinguished by "graining," which is easily done, and looks well. The title of a drawing is a feature that has much to do with its appearance, and the impression conveyed to the mind of an observer; and, while it can add nothing to the real value, it costs so little to make plain letter, that the apprentice is urged to learn this as soon as he begins to draw, not to make fancy letters, nor indeed any kind except plain block letters, which can be rapidly laid out, and consequently used to a greater extent. By drawing six parallel lines, making five spaces, and then crossing them with equidistant lines, the points and angles in block letters are determined; and after a little practice it becomes the work of but a few minutes to put down a title or other matter on a drawing so that it can be seen at a distance, and read at a glance in searching for sheets or details.

In the manufacture of machines, there are usually so many sizes and modifications, that the drawings must assist and determine, in a large degree, the completeness in matters of classification and record. Taking the manufacture of machine tools for example: we cannot well say, each time we want to speak of them, a 36-in lathe without screw and gearing, a 40-in lathe triple geared or double geared, with 20 ft. or 30 ft. bed, and so on. To avoid this it is necessary to assume symbols for machines of different classes, consisting generally of the letters of the alphabet qualified by a single number that designates capacity and different modifications. Assuming, in the case of engine lathes, that A is the symbol for lathes of all sizes, those of different capacity and modification would be represented in the drawings and records as A., A², A³, A₄, and so on, the letter and numerals together requiring but two characters to indicate a lathe of any kind. These symbols should be marked, in large, plain letters, on the left-hand lower corner of the sheet, so that the manager or workman or any one else can see at a glance what the drawing relates to This symbol should run through the time-book, cost account, sales record, and be the technical name for the machines, which should always be spoken of in the works by the name of their symbol.

In making-up time a good plan is to supply each workman with a small slate and pencil, on which he enters his time as so many hours charged to the respective symbols. Instead of interfering with his time, this will increase the workman's interest in what he is doing, and naturally lead to a desire to diminish the time charged to the various symbols.

When the symbols are added to a drawing, the next thing is the "pattern numbers" These should be marked in prominent, plain figures on each piece of casting, either in red ink or other colour that will contrast with the general face of the drawing These pattern numbers, to avoid the use of symbols in connexion with them, must include consecutively all patterns used in the business, these numbers can extend thousands without inconvenience.

A book containing the pattern record should be kept by the head draughtsman, in which these numbers are set down, with a short description to identify parts to which the numbers belong, so that various details can at any time be referred to. Besides this description, there should be, opposite the catalogue or pattern numbers, ruled spaces, in which to enter the weight of castings, the cost of the pattern, and, if needed, the amount of turned, planed, or bored surface on each piece when it is finished. In the same book the assembled parts of each machine should be set down, in a list, with its symbol and descriptive name, so that orders for castings can be made from this list without other references.

This system is the best one known to the author, and is in substance the plan now adopted in some of the best engineering establishments. It may be susceptible of improvement; he hopes it is; but let the apprentice seize on the idea of some system at the beginning; any plan is better than none, and the schooling of the mind to be had in the observance of systematic rules is the great point in view. New plans for promoting system may at any time arise, but they cannot be at any time understood and adopted except by those who have cultivated a taste for order and regularity.

In regard to shaded elevations, it may be said that photography has superseded them for the purpose of illustrating machinery, and but few establishments care to incur the expense of ink-shaded elevations. Ink shading cannot be done with various degrees of care, and in a longer or shorter time, there is but one standard for it, and that is that such drawings should only be made with great care and skill. A shaded elevation, although it may surprise and please the unskilled, is execrable in the eyes of a draughtsman or an engineer, unless it is a good one; and, as the making of shaded elevations can be of but little assistance to an apprentice draughtsman, it is better to save the time that must be spent in order to make a good drawing and apply the same study and time to other matters of greater importance.

It is not assumed that shaded elevations should not be made, nor that ink shading should not be learned, but to insist on the greater importance of other kinds of drawing, which are too often neglected to gratify a taste for picture making that has but little to do with mechanics.

Isometrical perspective is often useful in drawing, especially in wood structures when the material is of rectangular sections and disposed at right angles, as in machine frames. One isometrical view, which can be made nearly as quickly as a true elevation, will show all the parts, and can be figured for dimensions the same as plane views.

True perspective, although never necessary in mechanical drawing, may be studied with advantage in connexion with geometry, and often lead to the explanation of problems in isometrical drawing, and will also assist in free hand lines that have often to be made to show parts of machinery that are oblique to the regular planes.

Thus far the remarks on drawing have been confined to manipulation mainly. Unlike most branches of engineering work, drawing must as an art consist mainly in special knowledge, and is not capable of being learned or practised upon general principles. It is therefore impossible to give the learner much aid by searching after principles, and the few propositions that follow comprehend nearly all that can be explained in words.

Geometrical drawings consist in plans, elevations, and sections; plans being views on the top of the object in a horizontal plane; elevations, views on the sides of the object in vertical planes, and sections, views taken on bisecting planes, at any angle through the object. Drawings in true elevation or in section are based upon flat planes, and give dimensions parallel to the planes in which the views are taken. Two elevations taken at right angles to each other, fix all points, and give all dimensions of parts that have their axis parallel to the planes on which the views are taken; but when a machine is complex, or when several parts lie in the same plane, three and sometimes four views are required to display all the parts in a comprehensive manner.

Mechanical drawings should be made with reference to all the processes that are required in the construction of the work, and the drawings should be responsible, not only for dimensions, but for unnecessary expense in forging, fitting, pattern making, and moulding. Every "piece" that is laid down has something to govern it that we will term a "base," some condition or functions, or position that, if understood will suggest its size, shape, and relation to other parts. By searching after a "base' for each and everything, we proceed upon principles, avoid error, and continually maintain a test of what is done. Every wheel, shaft, screw, or piece of framing should be made with a clear view of the functions it has to fill, and there are always reasons why such parts should be of a certain size, have such a speed of movement, or a certain amount of bearing surface. These reasons or conditions may be classed as *expedient*, *important*, or *essential*.

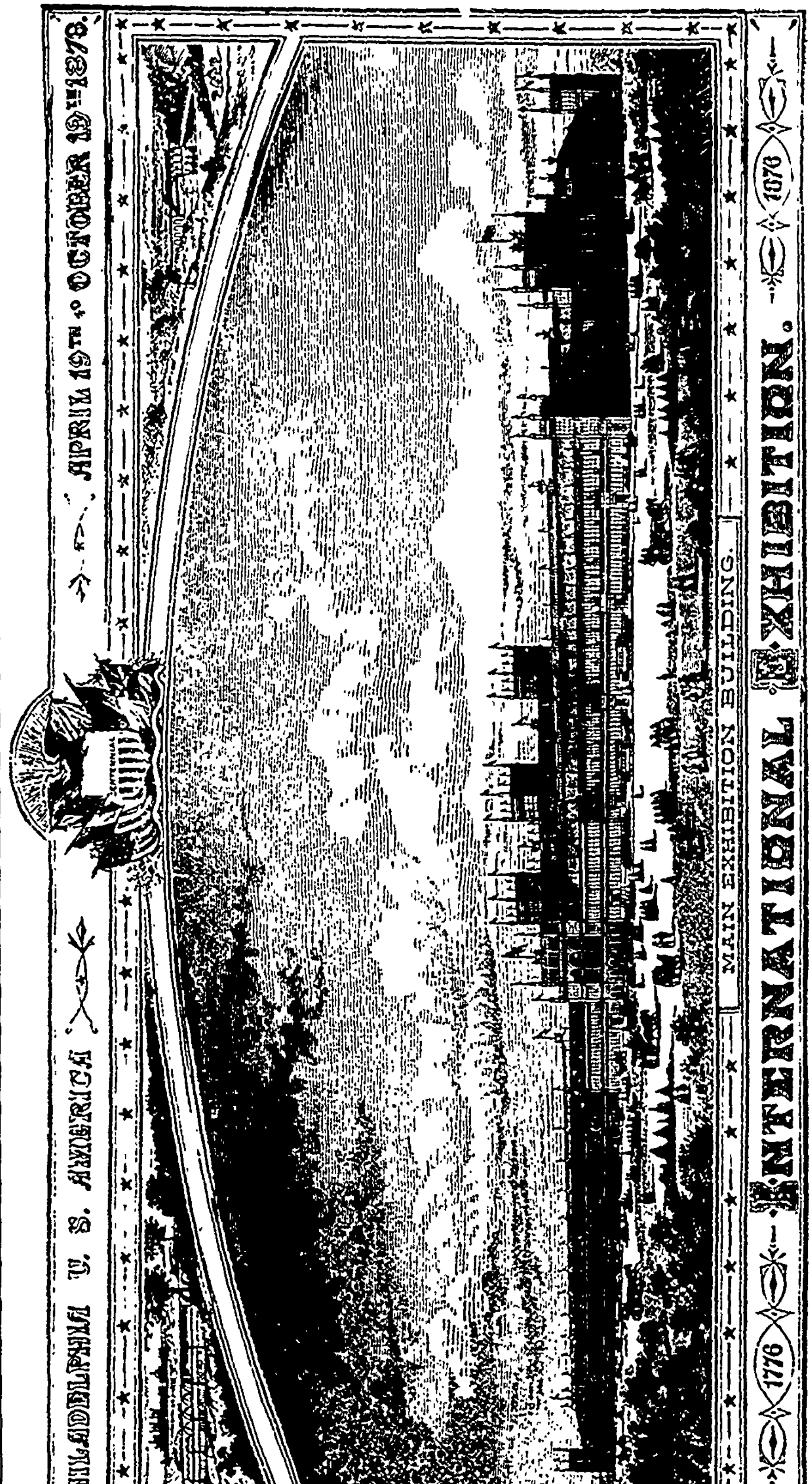
I now come to note a matter in connexion with drawing to which the attention of the apprentice is earnestly called, and which if he neglects, all else may be useless. I allude to indigestion, and its resultant evils induced by drawing. All sedentary pursuits give rise to this trouble, but none of them can compare with drawing, where every condition in the way of promoting this derangement exists.

In drawing, the muscles are at rest, circulation is slow, the mind is intensely occupied, robbing the stomach of its blood and vitality, and worse than all, the mechanical action of the stomach is arrested by leaning over the edge of the drawing board. I regret my inability to give any fixed rule to avoid this danger, but am at the same time confident that any apprentice who understands the danger can avert it by applying some of the logic which has been recommended in the study of mechanics. We can conculde that if anything tends to induce indigestion, its opposite tends the other way, and will arrest it; if stooping over the drawing board interferes with the action of the digestive organs, leaning back does the opposite; therefore keep your board as high as possible, stand at your work, and cultivate a constant habit of straightening up and throwing your shoulders back; if possible, take brief intervals of vigorous exercise.

Like rating the horse power of a steam engine, by multiplying the force into the velocity, we must estimate the capacity of a man by multiplying his mental acquirements into his vitality. Latent power is of no use, neither is latent knowledge nor skill.

Physical strength, bone and muscle, form some of the elements in successful engineering experience, and a store of these things must be laid in at the same time with a mechanical education, or it will be found that when ready to enter upon a course of practice, that most important element, the propelling power, has been omitted.

*To be continued*




## MEXICAN AND NEVADA SILVER MINES COMPARED.

Until the development of the large ore bodies in the Comstock lode, Mexico was the largest silver producer in the world. It is impossible to say what mine or what lode yielded the largest quantity of bullion. The best authorities on the subject have failed to determine, because the product of a group of mines operating on various veins in the same neighborhood has generally been credited to the leading mine in the district. Such has been the case, in a measure, with mines of Guanajusto, situated on the mother vein or *veta madre* of Central Mexico, and with the Potosi mines of Peru, the San Luis Potosi mine being credited with the combined product of a multitude of mines in that district, representing as many separate and distinct veins. The *veta madre*, of Mexico, comes nearest being a parallel case to the Comstock. It is a similar fissure intersecting a similar formation, only it is at least three times its length and its ore deposit has been one continuous *bonanza*. The mines on the *veta madre* have been worked uninterruptedly for over three centuries, and the aggregate yield is estimated at $300,000,000. The first discoveries on the Comstock were only made fifteen years ago, but the entire produce during that brief period has aggregated in round numbers $175,000,000, or over one half the three century product of the richest vein in Mexico, and about one eighth the entire product of the numerous veins and mines forming the Peruvian Potosi group for the same extended period. The yield of the Comstock lode last year amounted to about $21,000,000, and this year about $22,000,000, or within three millions dollars of the maximum annual yield of all true silver mines of Mexico, and five times the average annual yield of the Peruvian mines.

The *veta madre* has been more extensively worked than any other silver lode in Mexico, but it is very doubtful as to whether it is the richest vein existing in that country. The metallic silver lodes in the state of Chihuahua are probably much richer. A single *bonanza* of metallic silver ore, discovered in one of these mines, is represented to have taken eighteen years to exhaust, and is variously estimated to have yielded from $20,000,000 to $50,000,000. First class ore from the Chihuahua mines yield all the way from $15,000 to $30,000 per ton, and second-class ore ranges from $2,000 to $15,000 per ton. The Comstock, of course, has nothing equal to this. There is no knowing what might have been accomplished in the silver mines of Mexico and Peru had they been systematically worked. What if, instead of human backs, long, swinging poles and rickety winzes bringing the ore to the surface from the depths below, and the primitive arastras separating the metal from the vein matter, the improved machinery now employed on the Comstock had been in use! Under such a condition of things, what would have been the showing in the returns? and into how brief a space would the three-century operations have been contracted? Instead of a *bonanza* taking eighteen years to exhaust, we should probably have had it all out within that many months. Many of the Central Mexico mines have for years been worked by English capitalists, with improved machinery, and there has been, in consequence, a marked increase in the silver product of the country; but the mechanical appliances are vastly inferior to those used on the Comstock. The Comstock has unquestionably yielded more silver in the same space of time than any other mine, and is to-day the richest silver lode being worked, but its immense yield is in a great measure owing to the superiority of the machinery employed and the systematic manner in which it is being mined.

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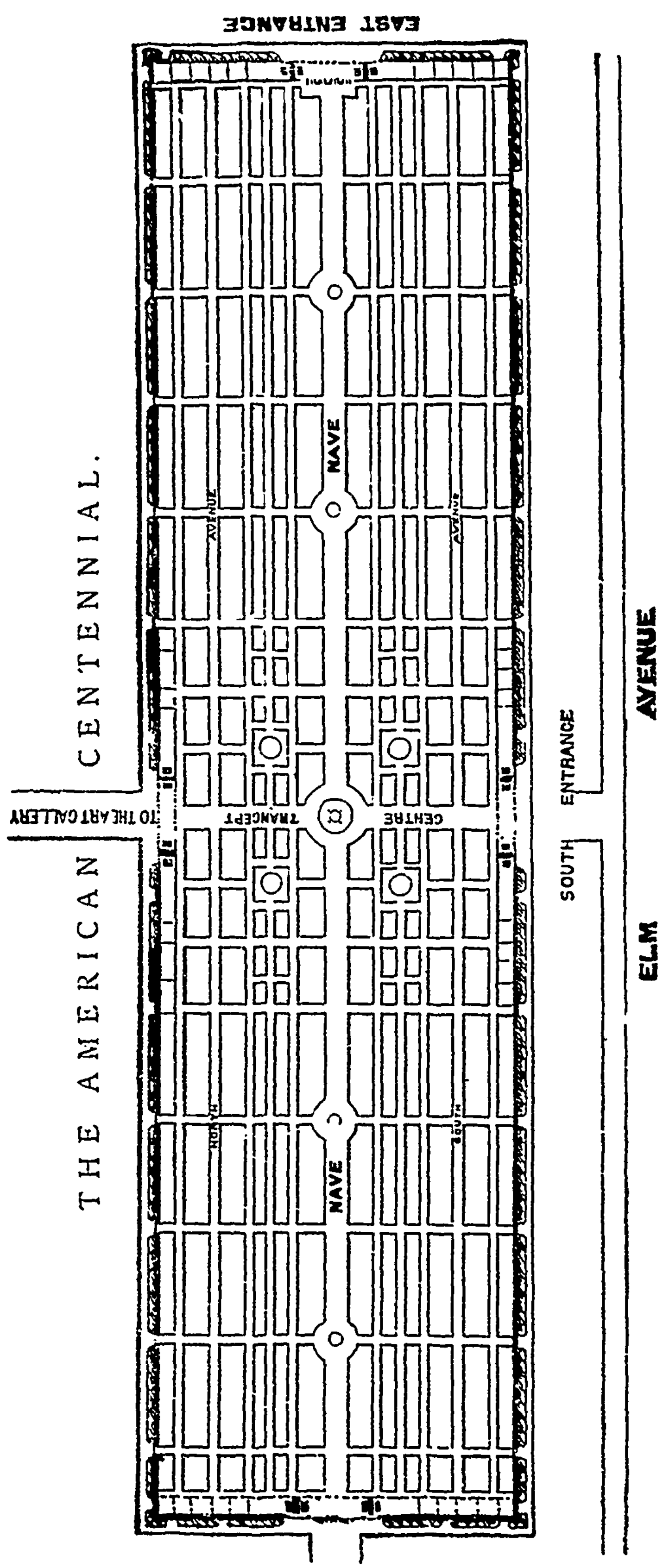
MACKILLOP PASHA, the Controller-General of ports and light-houses to the Egyptian Government, according to the *Pall Mall Gazette*, arrived the other day at Suez from Ishmalia He is, it is stated, about to examine the rich deposits of salt known to be in the vicinity of the Bitter Lakes. There are large tracts of country in that neighbourhood covered with a crust of pure salt of from 1in. to 2in. in thickness, and in some places it is even more. The Khedive has some idea of working this valuable mine which has been so long neglected, and of sending the produce to Suez for shipment by way of the Sweet-water Canal. There is likely, however, to be some dispute, it is said, with the Canal Company about this salt, owing to their claim upon a certain amount of land on either side of the canal, and one of the richest deposits lies very close to their concession. Beside salt, there are large beds of gypsum in the same neighbourhood, and in one place the canal was actually cut through a deposit of that valuable substance, and large masses may be seen on either bank, apparently thrown carelessly aside. The Egyptian Government has a guard stationed to protect the salt, and there is no doubt that steps will very shortly be taken to bring it to market.

THE imperfections of the diamond, and in fact of all gems, are made visible by putting them into oil of cassia, when the slightest flaw will be seen.



PLAN OF MAIN BUILDING, CENTENNIAL EXHIBITION.

# MECHANICS' MAGAZINE.

MONTREAL, MARCH, 1875.




## IS ALCOHOL FOOD?

This is one of the questions of the present day to which the voice of scientific men returns various answers. The prevailing idea seems to be that it is food in a very small degree. The latest authoritative announcements on the subject have been made in a very interesting series of lectures by Dr. Richardson. He comes to the conclusion that alcohol cannot by any ingenuity of excuse for it be classified among the foods of man It neither supplies matter for construction nor heat. On the contrary, it injures construction and reduces temperature. This conclusion is the result of a long series of experiments, extending over three years, on warm-blooded animals of various kinds including birds; on the human subject in health and on the same subject under alcoholic disease. Foods, as supplied to the human system, are of two kinds, tissue-building foods and heat-supplying foods. Nitrogenous bodies perform labour of the first kind, tissue-building, and probably are, to a small extent, heat-producers too. Alcohol, however, contains no nitrogen and cannot therefore rank as a tissue-building food. This conclusion will surprise many who have noticed how ale fattens people, but this fattening is claimed to be a result not of the alcohol but of the sugar or starchy matter which is taken along with it, and it would appear that drinkers of pure spirit, *i. e.* spirit unmixed with sugar do not fatten upon it There is some little difficulty however in coming to a correct conclusion as to the production of fat in the system. It is a well-known fact that those who drink to excess are subject to a fatty degeneration of internal organic structures, but on the other hand, all alcoholics are not thus affected and many who do not use alcohol at all are thus affected. On the whole the evidence as adduced seems to be conclusive that alcohol as a constructive agent in the human system is utterly powerless. The question then arises can it be a producer of energy or a developer of heat in the system. It is pretty generally understand now that food is, as it were, burnt up in our bodies giving out as a result of the combustion energy and heat. Now alcohol contains two combustible elements, carbon and hydrogen and may it not be that by its combustion in the body, as in air, it may be used to produce power and heat? This question is not so easy to answer satisfactorily as the first. There is no doubt but that alcohol is used up in the body, that it is assimilated in some manner. Careful and long continued experiments have been made by many scientific men on this subject. The late Dr. Anstie, especially, made some exhaustive experiments in the matter, and came to the conclusion that of the alcohol administered but a very small fraction was yielded by all the secretions combined. He proved that an animal, a terrier dog, weighing 10 lbs., could take with comparative impunity nearly 2,000 grains of absolute alcohol in ten days, and that on the last day of this regimen he only eliminated by all the channels of elimination 1·13 grains of alcohol. This fact was of itself sufficiently remarkable, but another still more important remains to be told. In completion of his research after an animal had been treated with alcohol, as above described, Anstie killed it, instantly and painlessly, two hours after it had received the last quantity—95 grains—of spirit. Then the whole body, including every fragment of tissue with all the fluid and solid contents, was subjected to analysis, with the result of discovering only 23·66 grains of spirit.

Alcohol it thus appears is decomposed in the animal body. By its decomposition in air heat and power may be obtained and why may it not then in the other case? The answer to this is that it is not. As a result of his researches Dr. Richardson recognizes four progressive stages of change of animal function from alcohol which are shortly described as follows:

The first is a stage of excitement when there exists that relaxation and injection of the blood vessels of the minute circulation with which we have become conversant. The second is the stage of excitement with some muscular inability and deficient automatic control The third is a stage of rambling, incoherent, emotional excitement, with loss of voluntary muscular power, and ending in helpless unconsciousness. The fourth and final stage is that in which the heart itself begins to fail, and in which death in extreme instances of intoxication closes the scene These stages are developed in all the warm-blooded animals, and the changes of temperature throughout the whole are relatively the same.

In the first stage the external temperature of the body is raised. In birds—pigeons—the rise may amount to a full degree, on Fahrenheit's scale, in mammals it rarely exceeds half a degree. In man it may rise to half a degree, and in the confirmed inebriate, in whom the cutaneous vessels are readily engorged, I have seen it run up to a degree and a half. In this stage the effect on the extremities of the nerves is that of a warm glow, like what is experienced during the reaction from cold.

The heat felt in this stage might be considered as due to the combustion of the alcohol, it is not so; it is in truth a process of cooling. It is from the unfolding of the larger sheet of the warm blood and from the quicker radiation of heat from that larger surface. During this stage, which is comparatively brief, the internal temperature is declining; the expired air from the lungs is indicating, not an increase, but the first period of reduction in the amount of carbonic acid, and the reddened surface of the body is so reduced in tonicity that cold applied to it increases the suffusion It is this most deceptive stage that led the older observers into the error that alcohol warms the body.

In the second stage, the temperature first comes down to its natural standard, and then declines below what is natural. The fall is not considerable. In birds it reaches from one and a half to two degrees. In other animals, dogs and guinea pigs, it rarely exceeds one degree; in man it is confined to three-fourths of a degree. In a room at the temperature of 65° or 70° the decrease of temperature may not actually be detected, but it is quickly detected if the person in whom it is present pass into a colder atmosphere, and it lasts, even when the further supply of alcohol is cut off, for a long period, viz., from two and a half to three hours. It is much prolonged by absence of food.

During the third degree the fall of temperature rapidly increases, and as the fourth stage is approached it reaches a decline that becomes actually dangerous. In birds the reduction may be five degrees and a half, and in the other animals three. In man it is often from two and a half to three degrees. There is always during this stage a profound sleep or coma, and while this lasts the temperature continues reduced.

Thus it would appear that alcohol fails also as a heat producing food, that it is in fact a lowerer of the temperature. These facts are of great interest to those living in cold climates like ours when spirits are so frequently taken to "keep one warm." That they really are useless for this purpose might be argued forcibly from other data. It is well-known that men exposed to long continued cold cannot venture to use spirits. Our lumbermen never hardly see a drop of alcoholic liquor when at work, tea is their only drink and they leave the woods in spring after performing the severest kind of labour, stronger and heavier than when they entered them in the autumn. Another important result to be derived from these researches is the possibility of enabling our police officers to distinguish between a man in an intoxicated condition and one in an apoplectic fit The difference can easily be detected by taking the temperature of the individual and it would appear that great care should be taken not to allow those under the influence of alcohol to remain cold, a cold damp cell is almost a grave to the sufferer from alcoholic excess.

## CANADA AND THE AMERICAN CENTENNIAL.

Our present number contains a series of views and plans descriptive of the buildings for the International Exhibition to be held at Philadelphia in 1876.

The subject is one of very great interest to all of us in Canada, and the Government has understood this by the early appointment of a Canadian Commission. The Exhibition will be held at Fairmount Park, Philadelphia. It will be opened on the 19th April, 1876, and closed on the 19th October following. All Governments have been invited to appoint Commissions, for the purpose of organizing their departments of exhibition. The Director-General should be notified of the appointment of such Foreign Commissions before January 4, 1875 Articles intended for the Exhibition must be sent in from the 1st January to the 31st March, 1375. Applications for space must be addressed to the Secretary of the Canadian Commission before the 1st May, 1875.

The Exhibition area comprises 1,200 acres, and, as will be seen from the view in our present number, it lies in romantic grounds. T' Industrial Building is 1,880 feet long by 464 feet wide. Its height is 70 feet, and the altitude of its towers 120 feet. The distribution of the interior is superb. It is divided into parallel zones lengthwise to the building, for productions of the same class. It is divided into parallel sections crosswise to the building, for countries and States. Thus, going down the lines in one direction, the observer sees the same products of the whole world, as, for example, furniture, stoves, sewing machines, and the like. Going along the cross lines, he follows the products of the same country. The Art Gallery measures 365 feet by 210. The height of its dome is 150 feet.

In our last volume we gave an illustration of this building but we repeat it in the present number in order that our illustrations may form a sort of guide complete in one number.

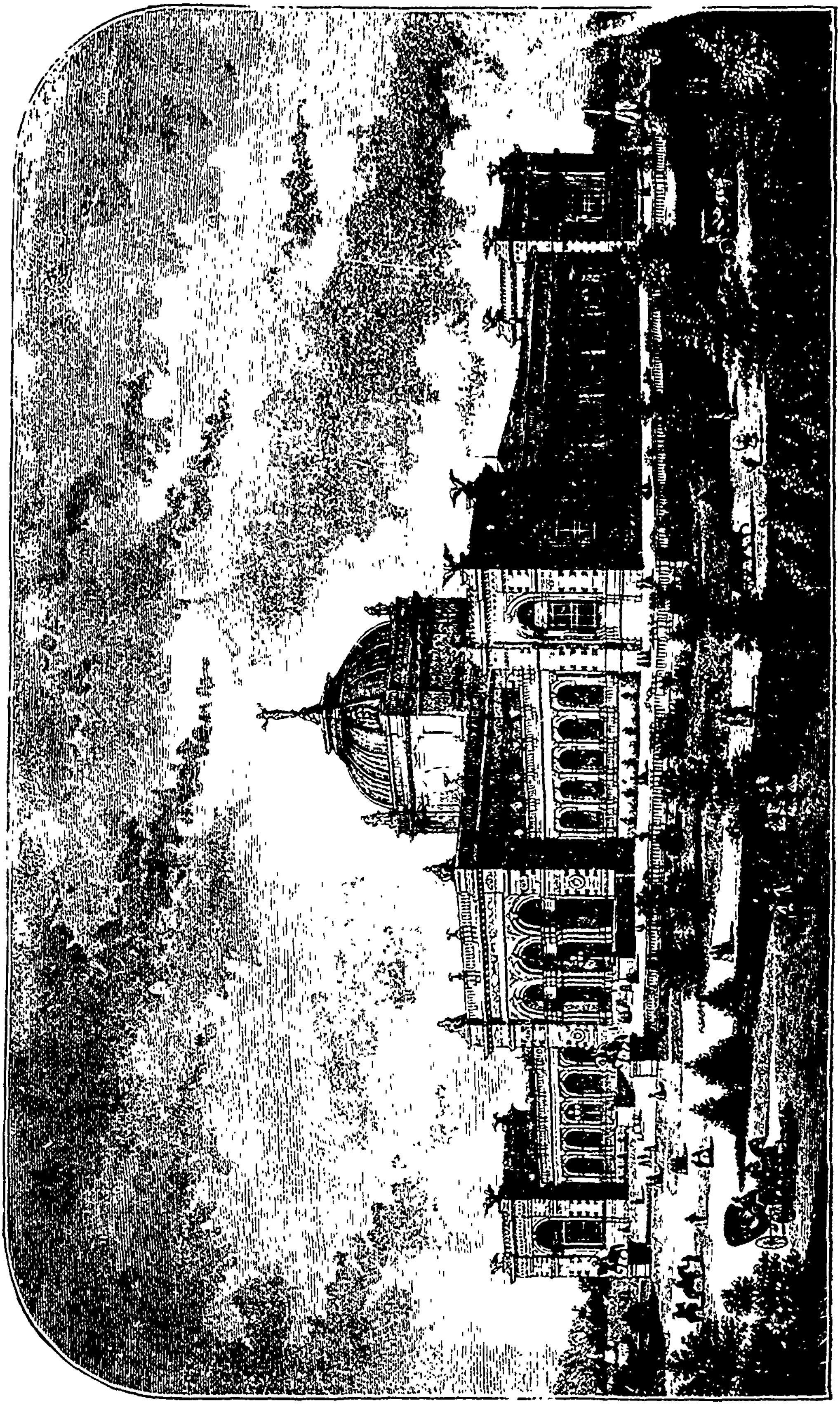
There are also a Machinery Hall, and an Agricultural and Horticultural Building. The whole buildings cover 50 acres of ground In September, a great cattle show will be held, lasting from one to five weeks.

The Canadian Government has allotted $100,000 to our Commission for this year, and will probably vote as much next year. It is expected also that each Province will furnish a contingent. The Commission is very satisfactorily chosen. It consists of Mr F W Glen, of Oshawa, representing Ontario; Hon E. G. Penny, of Montreal, representating Quebec; and ex Lieut.-Governor Wilmot, of New Brunswick, representing the Maritime Provinces. The Minister of Agriculture, Hon. Letellier de St. Just is *ex officio* President of the Commission; and Mr Joseph Perrault, of Montreal, is the active and intelligent Secretary. In this connection, we have the pleasure of announcing a capital project designed by the Commission. It is proposed to hold a general Dominion Agricultural and Industrial Fair at Montreal, in September of this year. The ground chosen is Logan's Farm, and it will be the largest exposition of the kind ever held in Canada. We understand that the City Council will contribute $40,000 towards it. At this Fair, all articles intended for the Philadelphia International Exhibition will be presented. There they will be carefully selected, packed, and prepared for transmission to Philadelphia by February, 1876. The charges thither and back will be paid by the Commission. Of course, those who do not chose to send their articles to Montreal, are at liberty to act as they please, but if they wish to exhibit at Philadelphia, without passing through inspection at Montreal, they will have to pay their own freightage to Pennsylvania. From all that we can learn, the American Centennial will be a genuine success, and the preliminary fair at Montreal will be proportionately great The one will help the other, and the result will doubtless be a decided impetus given to Canadian industry and Agriculture. Canada has been allotted a nearly central space in the main building at Philadelphia, along side of Great Britain, but as that space, like all others, is necessarily limited, we should advise intending exhibitors to confer at once with the Secretary of the Canadian Commission. We need scarcely add that articles intended for display at the International Exhibition will be allowed to go forward to the Exhibition buildings, under proper supervision of Customs officers, without examination at ports of entry, and at the close of the exhibition will be allowed to go forward to the port from which they are to be exported. No duties will be levied on such goods, unless entered for consumption in the United States.

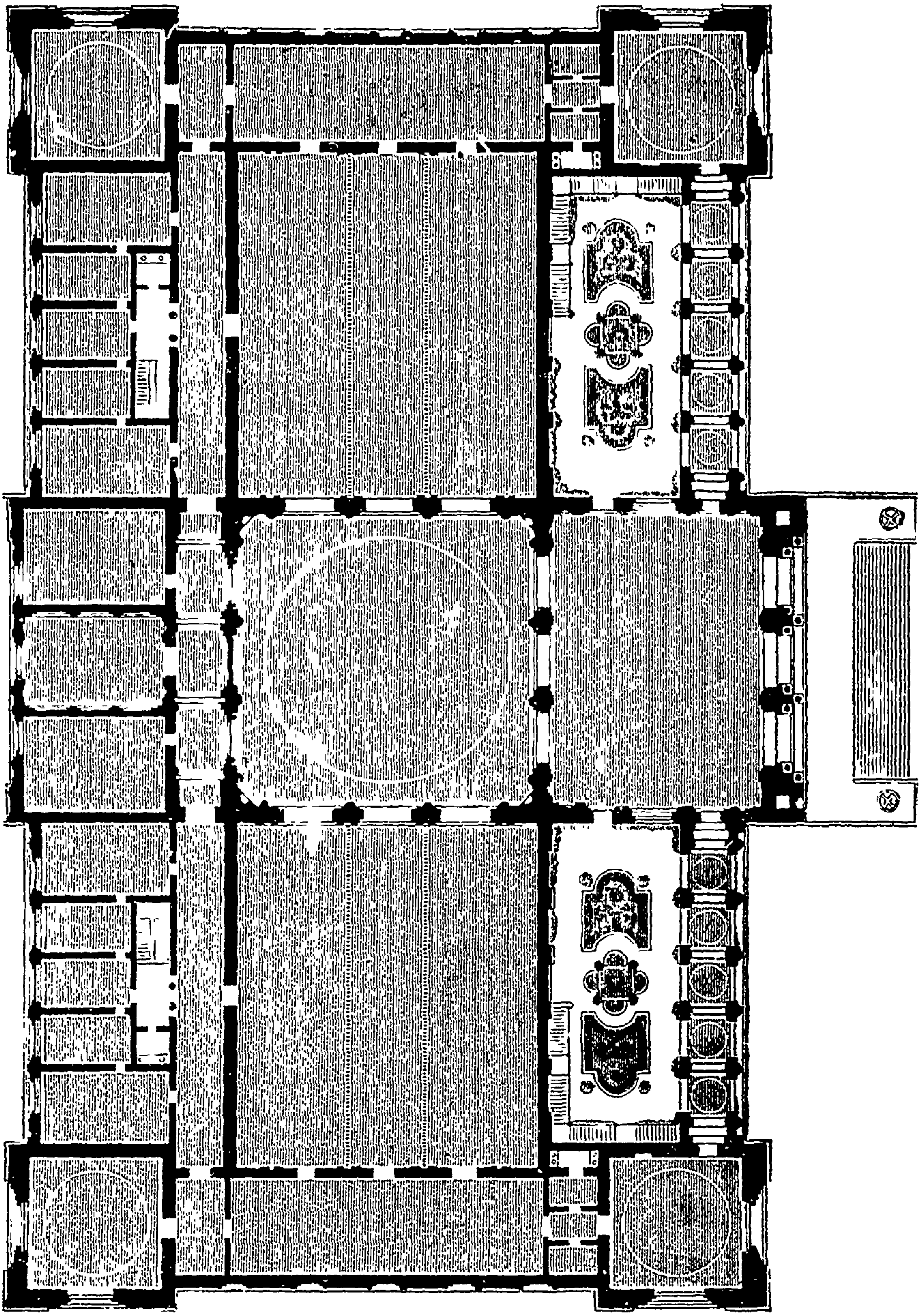
## PROPOSED NIAGARA BRIDGE AT LEWISTON.

We learn from the *Scientific American* that the practicability of constructing a permanent bridge at Lewiston across the Niagara is at present under consideration. The illustration on page 88 represent a plan of a practicable bridge sent to that journal by Messrs. Clarke, Reeves and Co., the well-known bridge builders of the Phœnixville bridge works.

Lewiston, is situated some seven miles below Niagara Falls; and at this point the river emerges from the narrow gorge, which varies from 200 to 400 feet in width, after making a last gradual descent of some 250 feet. Messrs. Clarke, Reeves



FINE ARTS BUILDING, CENTENNIAL EXHIBITION



PLAN OF FINE ARTS BUILDING, CENTENNIAL EXHIBITION

& Co. state, with reference to their proposed bridge, that the span is 600 feet. The structure is designed for a double track railway, 120 feet above the level of the river, and for a carriage way, beneath this road a distance of 75 feet. The estimated cost is $800,000. The difficulty, therefore, of erecting a single span, over swift rapids and where the water is practically unfathomable, the manufacturers claim to have overcome, and they offer to contract for construction as soon as a company is ready to supply the funds Instead of occupying twenty years in building, Messrs. Clarke, Reeves & Co., with their present facilities, believe that the work could be accomplished in as many months.

## RAILROAD IN SOUTHERN FRANCE.

The viaduct which we illustrate on page 73 is constructed over the Allier, a tributary of the Loire, and forms part of a new line of railroad, over a hundred miles long, between Alais and Brioude. In the construction of this line it was necessary to surmount natural difficulties greater than have presented themselves in the case of any other European railway. Alais is situated about 90 miles North-west of Marseilles and Brioude to the north of Alais, on the Allier. It will thus be seen that the road traverses the Cevennes mountains. Some idea of the difficulties of construction may be obtained from the fact that at one point in eleven kilometres of line there occur fourteen viaducts and eleven tunnels, and, at another point, in ten kilometres, twenty-one tunnels and eleven viaducts. One of these over the Allier at Villefort is the subject of our illustration The line will be very useful in relieving the direct road from Marseilles to Paris of some of its superabundant traffic and will also be of considerable strategic importance.

## LIGHTING UP THE GHOST AT THE ROYAL POLYTECHNIC, LONDON.

Many of our readers must have seen the "ghost," as it was exhibited often in Canada by its original inventor Professor Pepper. The exact method of its production is not, however, so generally well-known that it may not be made clearer by our illustration.*

As most of our readers are aware the "ghost" is the reflection of a living person thrown on to a large sheet of plate glass, so placed on the stage as to be invisible to the audience. In nearly all the representations on the stage of the large theatre of the Polytechnic this glass exists, but, by the ingenuity of the scene painter, is not observed. To effect this, much care and trouble are required. First, the glass must be placed at such an angle and elevation that not only no part of the house or stage shall be reflected thereon, but that the whole of the audience shall distinctly see the "ghost." In the next place, the scene must be so arranged that the living representative of the "ghost" shall be properly concealed, as well as the lime-lights which are to light it up. Many very beautiful effects have been produced by these means, and none more beautiful than the illusion of the White Lady of Avenel, which some year or so back delighted crowded audiences for weeks. A ghost illusion of some sort is usually to be seen at the Polytechnic. The effect introduced into the new Christmas entertainment called the "Mystic Scroll" is very striking. It consists of the vivification of the face of a stone statue, which, upon being addressed in certain mystic words, lives for a few moments, open its eyes, and speaks The illusion is very weird and effective.

## FIRE-PROOF PILLARS.

The introduction of iron columns is probably the leading characteristic of modern ordinary construction. Hardly a shop-front is erected but we see a few slender pillars supporting an immense superstructure of stone or brick, and in our large factories iron pillars are about the only support of heavy machinery, raw material and numerous operatives The columns are all that can be desired under ordinary circumstances. They are strong and they do not occupy much space. Their great draw-back is in the case of fire. A column that will support a certain given weight when cold will, when heated far below the melting point, give way under a fractional part of that weight, or if when heated it is played upon by a stream of cold water it will fly to pieces and down comes the superstructure, crushing in its fall the contents of the building and perhaps also, sundry luckless firemen. We see, in an Ontario paper that a patent has been secured by the Rev. Geo. Bruce of Aurora for an iron column in which these defects are to a great extent removed. It is described as follows :—

The invention is a simple one, and consists in applying the principle of the fire-proof safe to an iron column. As in the case of the common iron pillar, a solid cast-iron column sustains the whole weight of the superstructure, but outside of this solid column is a thin cast-iron shell, and the space intervening between the outer shell and the inner column is filled with plaster of Paris, the non-conducting properties of which are well known. No weight is allowed to rest on the outer shell or the non-conductor that is used as filling, their only mission being to protect from the effects of the heat the real support of the building, the inner column. These columns will be surmounted by an iron T girder, which is also enclosed in a fire-proof casing of a similar nature, and the junction between the pillar and the girder is so formed that only the protected portion of the one touches the protected portion of the other, while the casing form a tight joint, making the fire-proof armour complete. These columns are intended to take the place of iron columns in ornamental fronts of buildings, as well as in the interior of large warehouses where such supports are needed.

## CENTRAL ASIA.

Geographical discovery now finds its field not in the discovery of new lands, but in the exploring of vast inland countries. The interior of Asia is in many respects little better known than the interior of Africa, and any news from either as to new facts of geography, natural history, meteorology, &c., is hailed with delight by scientific men of all countries. Our knowledge of the interior of Asia has been greatly added to lately and it will not probably be long ere we are moderately well informed as to this vast and interesting region. A correspondent of the *Illustrated London News* who accompanied Sir J Douglas Forsyth's mission to Yarkund and Kasgar, writes to that journal as follows, concerning the Bactrian camel used in Eastern Turkestan :

During last year merchandise was transported on camels for the first time from Yarkund across the elevated plateau of the Karakorum to Ladak or Middle Thibet. It is probable that the employment of these hardy creatures along what is known as the Changchunnoo route will greatly assist our traders, who are forced to undertake the difficult journey across the highlands north of Thibet. The Changchunnoo route avoids the extremely difficult pass known as the Sasser, and is throughout less precipitous than what is termed the summer route, across the Karakorum. But it has one great disadvantage, that its extreme elevation is as much as 18,500 ft., and that many days have to be spent, during the transit, at an elevation greater than 16,000 ft., while the number of stages where neither grass nor wood is to be met with are greater than along the less easy road by which the present mission crossed the mountains. The hardy camel which is in use in this country is, however, as ready to face the lofty deserts of the Himalaya and the Pamir as the shifting sands of the Gobi desert. The home of the species here refered to is doubtless in the Oxus valley; but, now that the existence of wild camels on the western borders of China has been finally ascertained by the Russian officers who lately visited Kokonor and approached the Lama city of Lhassa, in Chinese Thibet, it becomes a matter of interest to know which of the species used by man is most nearly allied to the wild camel, whose very existence has so long been doubted."

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The scheme of building a tunnel between England and France is at last taking a practical shape. Two companies have been formed, an English one and a French. They are at present at work making experiments and if these turn out successful and practical it is probable that the English Parliament will shortly be called upon to give its sanction to the work. A bill in favour of the project is already before the French Assembly. It is estimated that if carried out at once, six years will see the completion of the undertaking. The time seems short for tunnelling thirty miles beneath the sea; but the work would be carried on from both ends and became a source of rivalry to the two interested nations and companies.

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Every now and again since the Indian mutiny a suppositious Nena Sahib has turned up, been tried and found to be the wrong man. The trial of the last of these has just been concluded with the usual result. The circumstance serves to show, however, what a deep and lasting impression was made on the mind of the English people by the atrocities then committed, an impression that many generations of peaceful lives will fail to efface. The scene of the most horrible massacre, that at the memorable well at Cawapore is now occupied by a beautiful monument of circular form enclosing a large space covered with small tombs and memorial momuments on which are engraved inscriptions to the memory of the sufferers. The monument was designed by Baron Marochetti and is constructed of white marble.

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The ice crop is said to be a good one everywhere in the northern hemisphere this winter and so it should be, judging from the reports of long continued frost from almost all directions. The business of storing it has assumed immense proportions in the Northern United States. There is a great and rapidly increasing demand for home consumption and it is exported to foreign parts in vast quantities. New York and its neighbourhood are supplied from vast storehouses on the Hudson similar to that in our sketch. The ice is issued daily from these, sent by train to the city and surrounding towns and there distributed. In spite of the unusually heavy crop consumers there are already grumbling in anticipation at the long price they will have to pay next summer for a scanty supply, as it seems that most of the business is in few hands and a sort of monopoly has steadily grown up. There would seem to be room for Canada to do something in this trade, in the exporting at any rate. Our ice should be better in every respect than theirs. It is frozen and stored at a much lower temperature and therefore contains less heat, and labour here in the winter months could certainly be obtained at a much lower figure than in New York State.

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In no case in general practice should the pressure, on even the slowest moving journals, be allowed to exceed 1,000 pounds per square inch of longitudinal section with steel journals, or about 600 on iron, in well worn boxes.

## ICE AND SNOW IN RELATION TO VEGETATION.

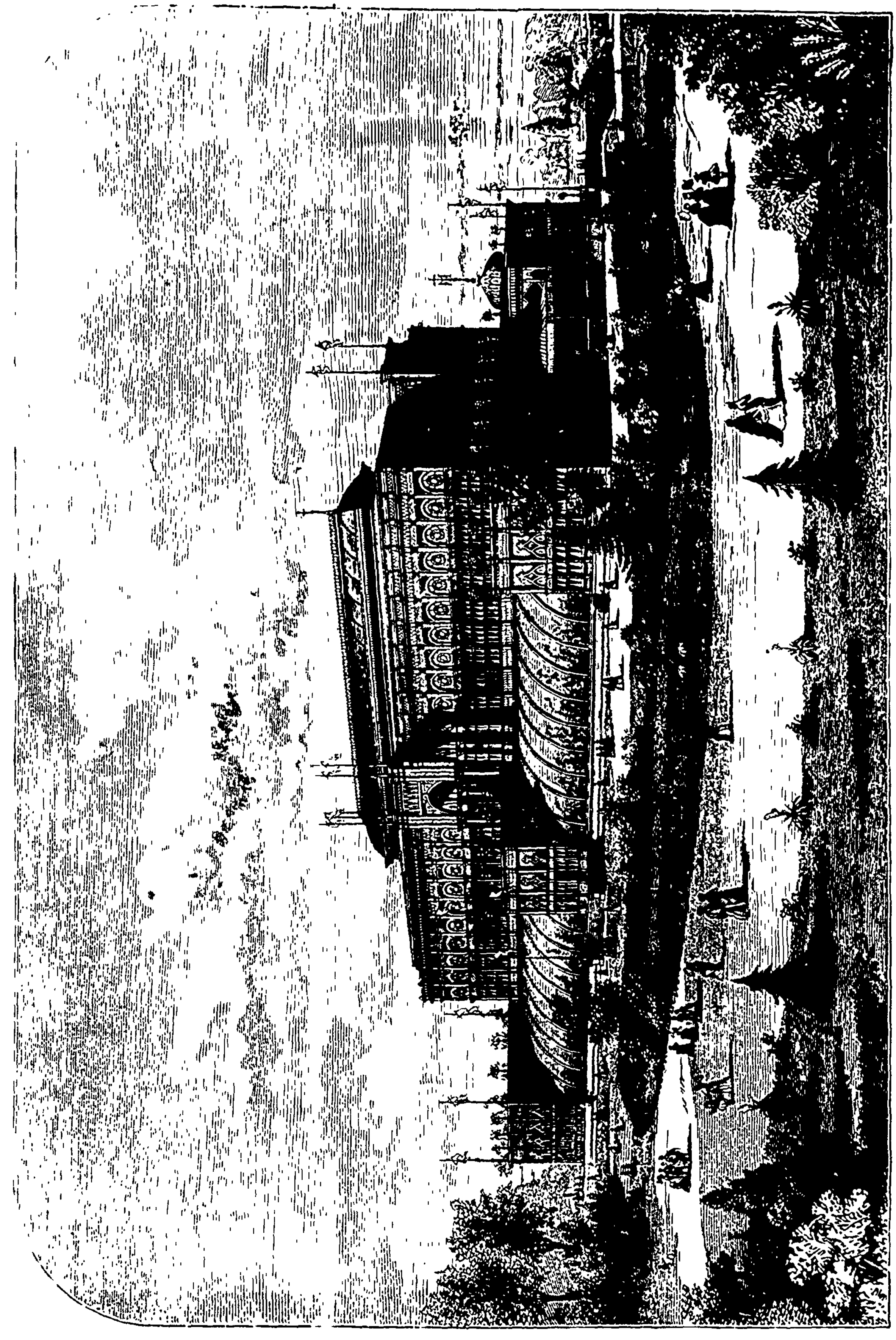
By general consent the frost is regarded as one of the best of cultivators. Stubborn clays, which almost defy the efforts of the farmer or the gardener with a steam-engine at their backs, yield to the cleaving influence of frost, or its other extreme, heat, with the docility of a child in the hands of a strong man. A clod, which the human clod which walks on the soil may try for days and weeks or months to reduce to fine tilth without effect, is no sooner grasped by frost or sunshine, and pierced quite through than by the first change of weather—let the first genial shower fall — it is disintegrated, and falls to pieces like so much lime or sand. Those who had had their ground ridged up or roughly dug in the autumn, will find their profit in the expenditure; those who have not done this will be wise to delay no longer, especially if the land under cultivation is of a strong nature.

Generally, amateur-gardeners shirk the necessary garden work in the winter, to the disadvantage of the garden. The crops being gathered, too frequently, the ground is left covered with weeds and rubbish till the spring. This is not only an untidy practice, but it is one positively injurious to the land, especially if we were to experience, as we did two years ago, a mild and very wet winter, when acres of wheat were left unsown, because it could not be worked for the purpose, and many a field of heavy garden soil was rendered useless the following summer. A winter's exposure, especially with heavy land, to the ameliorating influences of a winter's frost, is generally considered as being equal to a coat of manure; therefore we must insist that every vacant space should be immediately trenched or ridged up, leaving the surface of the soil as rough as possible, so as to expose it to the weather; and if during the continuance of frosty weather the ridges can be forked over so as to expose a fresh surface, it will not only be of benefit to the soil, but will also aid very materially in the destruction of insects and their ova.

This sort of work should be commenced in the autumn, as the various compartments become vacant. The ground always works best in fine weather, just after rain. If the top is wet and soddened, the working of the soil in that state does more harm than good, even to tread on it only; but as the weather at the fall of the year and in early winter is uncertain, every opportunity should be taken to ridge up every yard of land not occupied, for if it lays for a week only for sun, frost, snow, rain, and air to get upon it, its fertilising powers are vastly increased.

Let us now look at the constituent parts of snow and ice, and then go on to show how in the economy of nature they discharge most important functions in relation to the soil. Snow is the condensed vapour of the earth precipitated to the earth in a frozen form. Snow, then, is the effect of frost acting on the vapour in the air. On the other hand, ice is frozen water, and when the temperature of the air is reduced to thirty-two degrees, water will no longer remain in a fluid state. When the frost lays hold on newly-broken soil, for instance, the water that is absorbed by it during moist warm weather, expands by the action of the frost; the particles of the earth are therefore thrust apart from each other, leaving a vacuum between them. These openings in the soil let in air, dew, rain, and many gases favourable to vegetation, and more or less of fertilising deposits being thus made, the soil becomes invigorated and enriched, and strength is imparted to the young crops subsequently. Nor is this all, for when a thaw sets in and the ice of the clods dissolves, the particles of the earth, thrust apart by the action of the frost, being left unsupported, tumble into minute parts as soon as the binding cement of ice is dissolved. Thus a disintegrating process is wrought, and the beneficial influence of this on heavy stiff soils cannot be over-estimated. The falling rain can more readily penetrate the soil, and the peculiar composition of water makes it a very important circumstance to vegetable life. It consists of oxygen and hydrogen, and all the solid parts of animals and plants contain these same elements in large proportion. In the dry wood of the tree, for example, and in the dry flesh and bone of the animal, both are present. Now, as the plant and animal increase in size, oxygen and hydrogen are required for the formation of their growing parts, and water is every where at hand to supply these necessary ingredients. This is a chemical duty which no other liquid but water could equally perform. Water, in discharging this duty, is not merely the drink, as we usually call it, but is really part of the food both

AGRICULTURAL BUILDING, CENTENNIAL EXHIBITION



HORTICULTURAL BUILDING, CENTENNIAL EXHIBITION.

of animals and plants. Besides the oxygen and hydrogen in the water, other substances are found in the air; among them is nitric acid, and it consists of nitrogen and oxygen only. Every flash of lightning which darts across the sky, and every electric spark, great or small, which in any other forse passes through the air, causes a minute proportion of them two gases along the line of its course to unite together, and produce nitric acid This acid is very favourable to vegetable growth, and is, indeed, one of the substances which the falling rains and dews are appointed to wash out of the air, and in doing so to bring down to the soil, and to plants, a valuable form of food, which is thus daily prepared for them among the winds of heaven The disintegrating force of frost enables the substance also to readily penetrate the soil, where it remains stored up till required to build up vegetable tissue

What are the uses of snow? for there is no waste of energy in the forces of nature. In the first place it may be said to keep the earth warm in times of severe frost; and in the second place, it nourishes the mother on whose bosom it lies white and clear in winter. It is in this way that the snow may be said to keep the earth warm; it is a very bad conductor of heat, and the consequence is that where the surface of the ground is covered with snow, its temperature very rarely descends below freezing point, even in cases where the superincumbent air is fifteen or twenty degrees colder In one of the Psalms of David, the writer states, using a beautiful figure: "The Lord giveth snow like wool, he scattereth the hoarfrost like ashes"; at first sight it may appear strange to compare snow to wool, but wool is warm because air is entangled among the fibres of the wool, and air is a very bad conductor os heat; and also that air is entangled among the crystals of the snow; and air being a very bad conductor, there is a great appropriateness in the figure. The protective quality of snow, as a means of preventing injury to plants, has been abundantly illustrated. Let us go back to the intense frost which prevailed in 1860, and which reached its greatest intensity on Christmas Day in that year, and the few following days. We were at that time in one of the coldest districts of England, and where the frost reached its maximum of intensity. Trees and shrubs were ruthlessly cut down by the terrible severity of that winter; but only to the snow-line.

Snow is a nourisher in the sense that it supplies moisture containing carbonic acid, which penetrates slowly into the soil, and insinuates itself through every clod, ridge, and furrow, when the snow melts Water is an absorbent of the gases oxygen and nitrogen, of which the atmosphere chiefly consists, but not in the precise proportions in which they exist in the air. The air that we inhale into our lungs, when comparatively pure, contains about twenty-one per cent. of oxygen, but in the air which we can extract from water, it exists to the amount of thirty-one to thirty-three per cent. This tendency of water to dissolve more oxygen, in proportion to the nitrogen than exists in common air, explains another curious circumstance which long puzzled philosophers as well as ordinary people. If a bottle filled quite full with snow, be well corked and then put into a warm room, the snow will melt, and the bottle will be filled, perhaps, one-third with water and two-thirds with air. If this air be examined, it will be found to contain less oxygen than atmospheric air—sometimes not more than twelve or fourteen per cent.—while atmospheric air, as we have seen, contains twenty one per cent. Hence it was long supposed that the air, always present in snow, naturally contained this small proportion of oxygen, and that snow, therefore, possessed some peculiar property of absorbing the gases of the atmosphere in this new proportion. But the explanation is, that the snow, in melting into water, takes up a larger proportionate quantity of the oxygen than it does of the nitrogen of the air which was contained in its pores, and consequently leaves a smaller proportion behind. The inference is that carbonic acid gas is formed, permeating the soil as we have already shown, and laying up a store of food for the plant it rears. As the microscopic apertures in the leaf suck in gaseous food from the air, so do the extremities of microscopic hairs on the roots suck a liquid food from the soil.

But in what form the nutritive carbon actually enters the root of the plant, is a question about which physiologists are divided in opinion. It is probable that the carbonic acid of the soil deposited by the snow enters the root of the plant in combination with some other substance, and is afterwards decomposed within the plant itself.—*Land and Water.*

## RIBBON-WEAVING AT COVENTRY, ENGLAND.

(From the *Furniture Gazette.*)

As we enter the factory, preparatory processes are going forward at the top and the bottom of the building. In the yard is the boiler-fire, which sets the engine to work, and from the same yard we enter workshops where the machinery is made and repaired. The ponderous work of the men at the forge and anvils contrasts curiously with the delicacy of the fabric which is to be produced by the agency of these masses of iron and steel. Passing up a steep ladder, we find ourselves in a long room where turners are at work making the wooden apparatus required, piercing the "compass-boards" for the threads to pass through, and displaying to us many ingenious forms of polished wood. While the apparatus is thus preparing below, the material of the manufacture is getting arranged four stories overhead, there, under a skylight, women and girls are winding the silk from the hanks upon the spools for the shuttles. Here we see again the clouded silk which is to make plain ribbons, and the bright hues which delighted our eyes at the dyeing-house This is easy work, many of the women sitting at their reels, and the air is pure and cool. The ole edifice is crowned by an observatory, with windows all round, and no complete ceilings shut off the air between this chamber and the rooms of two stories below. Descending from the long room, where the winding is going on, we find ourselves in an apartment which it does one good to be in. It is furnished with long, narrow tables and benches, put there for the sake of the work-people who may like to have their tea at the factory in peace and quiet. They can have hot water, and make themselves comfortable here. Against the door hangs a list of books read, or to be read, by the people, and a very good list it is. Prints from Raffaelle's Bible, pl...y framed, are on the walls. In the middle of the room, on and beside a table, are four men and boys preparing the "strapping' of a Jacquard loom for work. The cords so called are woven at Shrewsbury. We next enter a room where a young man is engaged in the magical work of "reading in from the draught" The draught is the pattern of the intended ribbon, drawn and painted upon dice-paper. The young man sits as at a loom: before him hangs the mass of cords he is to tie into a pattern, close before his face, like the curtain of a cabinet piano. Upreared before his eyes is this pattern, supported by a slip of wood. He brings the hue he has to "read in" to the edge of his wood, and then, with nimble fingers, separates the cords by threes, by sevens, by fives, by twelves, according to the pattern, and threads through them the string which is to tie them apart. The skill and speed with which he feels out his cords, while his eyes are fixed on his pattern, appear very remarkable; but when we come to consider, it is not so complicated a process as playing at sight on the piano. The reader has to deal thus with one chapter, or series, or movement of his pattern. A *da capo* ensues—in other words, the Jacquard cards are tied together to begin again; and there is a revolution of the cards and a repetition of the pattern till the piece of ribbon is finished.

In the same apartment is the press, in which there seems plenty for one person to do; for there are thirteen broad ribbons, or a greater number of narrow ones, woven at once in a single loom, yet it may sometimes be seen that one person can attend the fronts and another the backs of two looms. In the front we see the thirteen ribbons getting made. Usually, they are of the same pattern, in different colors. The shuttles with their gay little spools fly to and fro, and the pattern grows as of its own will. Below is a barrel, on which the woven ribbon is wound. Slowly revolving, it winds off the fabric as it is finished, leaving the shuttles above to ply their work.

Some ribbons have an elegant and complicated pattern, and are woven with two shuttles (called the double-batten weaving), which come forward alternately, as the details of the rich flower or leaf require the one or the other. There were satin ribbons, in weaving which only one thread in eight is taken up, the gloss being given by the silk loop, which covers the other seven. The Jacquard cards are prepared just in the way which may be seen wherever silk or carpet weaving with Jacquard looms goes forward. All the preparations having been seen—the making of the machinery, the filling of the spools, the drawing and "reading in" of the pattern, and the tying of the cords, and strapping—we have to see the great process of all, the actual weaving. We certainly had no idea how fine a spectacle it might be. Floor above floor is occupied with a long room in each, where the looms are set as close as they can work, on either hand, leaving a narrow passage between. It may seem an odd thing to say, but there is a kind of architectural grandeur in these long, lofty rooms, where the transverse cords of the looms and their shafts and beams are so uniform as to produce the impression that symmetry on a large scale always gives. Looking down upon the details, there is plenty of beauty. The light glances upon the glossy colored silks, depending like a veil, from backs of the looms, where women and girls are busy piecing the imperfect thread with nimble fingers.

On entering, we saw some narrow scarlet satin ribbons, woven for the Queen. Wondering what her Majesty could want with ribbon of such a color and quality, we were set at ease by finding that it was not for ladies, but for horses. It was to dress the heads of the royal horses. There were bride-like, white-figured ribbons and narrow, flimsy black ones, fit for the wear of the poor widow who strives to get together some mourning for Sunday There were checked ribbons, of all colors and all sizes in the check. There were stripes of all descriptions. There were diced ribbons, and speckled and frosted There were edges which may introduce a beautiful harmony of coloring: as primroses with a lilac edge; rose-colored with a brown; puce and amber, and so on. The loops of pearl or shell edges are given by the silk being passed round horse-hairs, which are drawn out when the thing is done. There are belts — double ribbons — which have other material than silk in them. And there are a good many which are plain at one edge and ornamented at the other. These are for trimming dresses. One reason why there are few gauzes is that the French beat the English there. They grow the kind of silk that is the best for the fabric, and labor is cheap with them, so that any work in which labor bears a large proportion to the material is particularly suitable to them.

It is no uncommon thing to see the father weaving, his wife winding in another room, or perhaps standing behind a loom piecing the whole day long. The little girls fill the spools, and the boys are weaving somewhere else The consequences of this devotion of whole households to one business are as bad here as among the Nottingham lace-makers of the Leicester hosiers. Not only is there the misery before them of whole families being adrift at once when bad times come, but they are doing their utmost to bring on those bad times Great as is the demand, the production has thus far much exceeded it.

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A Correspondent of the St. Catharines *News* describes the parts of the skeleton of the unknown animal found on Mr Isaiah Wardell's farm in Canboro', near Dunville. The horn is about eight feet long, and twenty-eight inches in circumference, was probably about twelve or fourteen inches longer and several inches larger in circumference in its original perfect state; the large end of the horn has a tapering hollow of about four feet, and a curve of about twenty inches, and weighs 185 pounds in its green state: has probably weighed not less than 250 lbs. About half of the other horn is also exhibited, corresponding in size and shape, but much more decayed. Two jaw bones, or rather parts of them, having two grinders each, measuring 17 inches from the angle of the jaw-bone to the first tooth. The teeth measured about 7 inches by 3½. One loose tooth weighs 5¼ lbs. Several other bones, evidently belonging to the same animal, and all of a collossal size, such as the bones of one foot, joint of a leg, parts of the head, vertebrade, shoulder blade, and one rib, all of which attest that the animal must have been of an enormous size quite beyond any animal as yet known, or of which we have any skeleton, and judging from its size and weight of its teech and jaw bones, it must have been twice the size of the largest elephant. Mr Wardell intends searching for more of the skeleton as soon as the frost permits

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Says the Fredericton *Reporter*:—The New Brunswick Railway Company having concluded to push a branch line into Aroostook territory, great is the excitement among the various districts to secure the terminus, each declaring itself more consequential than the other. The line to Fort Fairfield will be adopted.

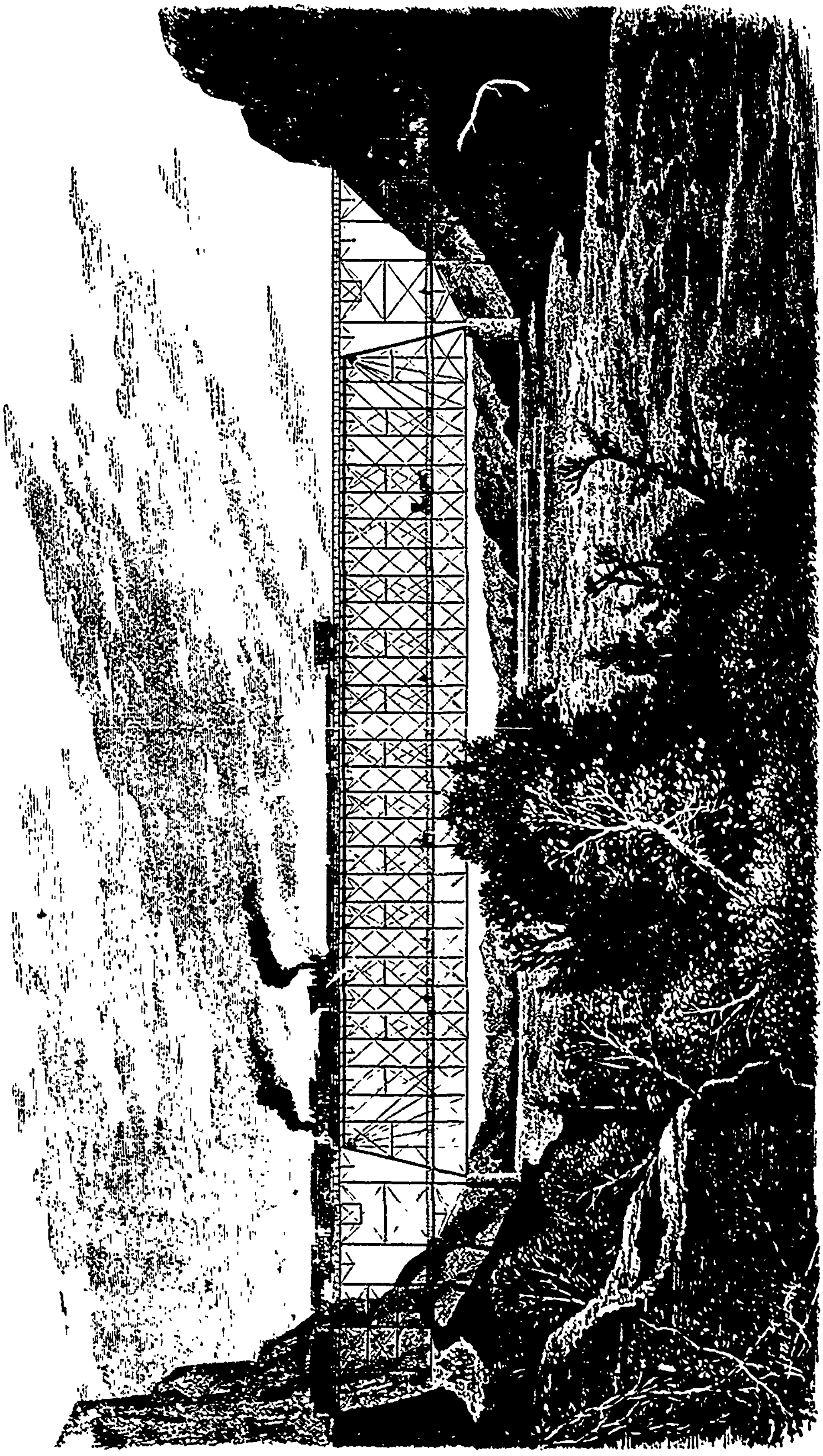
## SUPPRESSED GENIUS.

Sir J. Noel Paton, in addressing the students of the Royal Scottish Academy on the 1st inst., made the following happy remarks:—

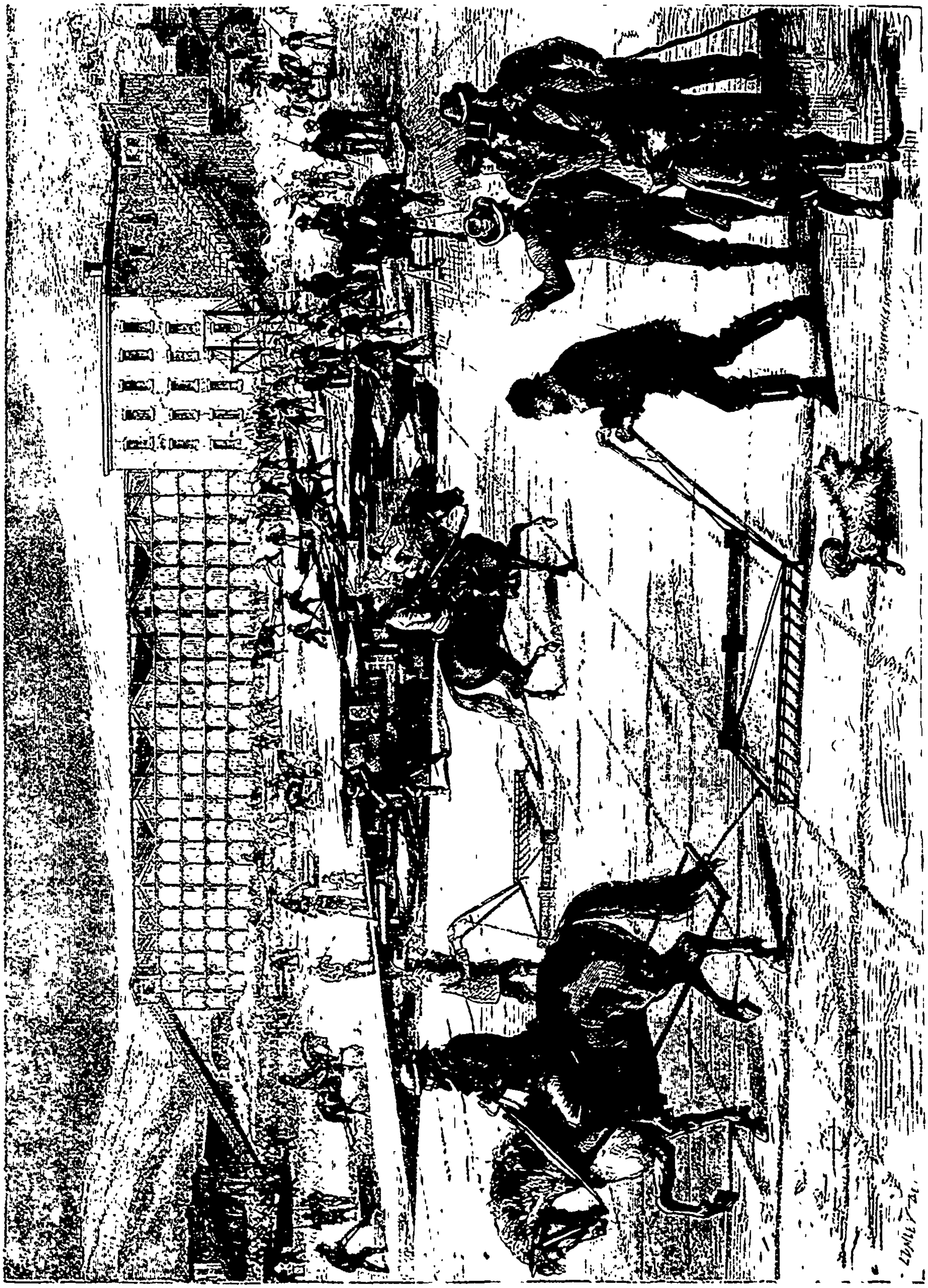
It has been said that there is no suppressed genius; that when the thing so called is within a man, it will assert and develop itself in spite of adverse circumstances. But I fear sad experience goes to prove that the race of "mute, inglorious Miltons" is not confined to the parish of Stoke Pogis, and that the amount of intellectual energy dissipated in every generation in unavailing conflict with ignorance, poverty, and disease is very great. The will and the wings may be given, yet both prove powerless for flight, through the weight of adverse destiny. Of this terrible law I had some years ago a touching illustration. Wishing to represent in a picture the chrysalis of a common white butterfly, and having too vivid a conception of the object to paint it from memory with any sense of satisfaction, I had three specimens sent me from the country. They were sent by a very intelligent gamekeeper, packed in fine cotton, and enclosed in a small tin shot-box. I painted in my chrysalis, replaced it beside its sisters in the shot-box, and put it away on the shelf of a cabinet, I suspect with no thought of the creature beyond the instinctive impulse to preserve from injury a thing so fragile and so beautiful. This was in early winter. Spring came. Summer and autumn followed, with more than their wonted splendour. It was again winter, when, in searching for something else, my eye fell on the little shot-box. Taking it up, I removed the lid, almost mechanically, for my mind was preoccupied, and quite unprepared for the sadly suggestive sight that presented itself. There, immediately beneath the lid lay a dead butterfly,—one beautiful wing outstretched against the polished metal in white perfection; the other, partially undeveloped, and still entangled among the cotton. Here surely was matter for thought. The chrysalis I had painted as tenantless was now indeed empty, the "antenatal tomb" had been burst asunder by the living Psyche within. The divine voice had called to her, as the divine voice once called to the swathed sleeper in the rock-tomb at Bethany, "Come forth!" and forth she came. Impelled by the divine instinct of her being, she had battled bravely and strongly through the dense superincumbent impediments. She had all but shaken herself free from the close clinging fibres; but there was no one to roll away the stone, to unloose the bands and let him go. Above her was the solid disk of iron, cold, dark, impenetrable. Against such an obstacle as this what could poor Psyche do? And thus, while her winged kindred were abroad in the summer air, and

> "The children were culling
> In a thousand valleys far and wide.
> Fresh flowers,"

the fiery spark within her had burnt itself out in unavailing conflict with the inevitable. Will and wings had indeed been hers, yet there she lay dead before me, her powers undeveloped, her aspirations unfulfilled,—the victim of circumstances. Lower down I found her sister. She, too, had heard the call, had felt the quickening impulse, and struggled to obey But for her circumstances had proved yet more adverse. She also had burst her cerements, but her wings had never been unfolded; and she, too, was dead, I doubt not to the third sister also the voice of the Master had penetrated, but her grave-clothes were unrent,—"She died, and made no sign" Before such an audience as this, it may seem a mere waste of words to insist on the supreme importance to the artist of thorough and early culture. But we have heard it maintained that an elaborate system of art-education which of necessity implies a more or less prolonged subjection of the recipient to the influence of other minds,—is unfavourable to that development of idiosyncracy which we call originality. But worthy originality in any of the arts may be defined as a new and unexpected development of the beautiful; and it is inconceivable that any originality which will bear this definition can be the outcome of ignorance Further, I contend that the artists whom the world has recognised as the most original,—the men whose works form the land-marks in the history of art,—have invariably been the most perfectly educated, that is, the most perfectly acquainted with the principles and practice of their predecessors.



PROPOSED BRIDGE OVER THE NIAGARA.



SECURING THE ICE CROP ON THE HUDSON.

## RAILWAY MATTERS.

The first train which run through the Hoosac Tunnel was composed of three gravel cars and a box car filled with 100 passengers, among them being State Engineer Benjamin Frost, Consulting Engineer Thomas Doane, Chief Engineer, W. P. Granger, &c. The passage was made in thirty-five minutes. The track is not yet in a condition fit for the running of regular trains.

The Pennsylvania Railroad Comp.ny have a car built and used expressly for the purpose of testing the correctness of the track scales along the line. The body of the car is of iron, and it is furnished with weights, by which the scales can be proved. It is started out from Altoona once each month, and makes the round of the road and branches, adjusting all the scales.

The force of men required to work a railroad is illustrated by the Illinois commissionners' report, which has a column for "number of persons employed—entire line.' We usually speak of the *employés* of a railroad company as an army, but some of the Illinois companies seem to get along with a corporal's guard. Two roads have put fifteen *employes* each, one of these roads being eight and the other seventeen and a-half miles long. The Sycamore and Cortland road, which is only four and a half miles long, however, employs but twelve men; but the smallest force is on the Louisville, New Albany, and St. Louis, twenty-seven and a half miles long, which reports but nine men. The total length of the roads reporting is 6740 miles and the aggregate number of their *employés* is 35,769, which is at the rate of 5·3 men per mile of road.

Railroad Train Timer.—An ingenious invention has lately been successfully tested on the Vandalia Railroad, Indiana, which records the motion of railway cars There is a locked iron box, attached to one side of the car, and containing a clock. The mechanism of the latter causes a small drum, on which is wound a sheet of paper, to travel at a constant rate. With the axle, by means of rods and gearing, a pencil touching this paper is connected. As the pencil is moved slowly across the paper, by its mechanism governed by the axle, and as the paper is slowly moved foward, the pencil point inscribes a diagonal line back and forth The paper is ruled in very small sections, every fourth line being dotted and representing one mile; so that, supposing the car goes a mile in four minutes, the line will cross just four sections diagonally from one dotted line to the next one. If the car stops, the line crosses the paper directly, and shows the number of minutes that the train is at rest. The names of the stations are written at the proper places on the paper, and thus the exact rate of speed made at any point on the line can be subsequently noted. The apparatus thus affords an excellent check on the train officials, as, if the train gains or loses time, the fact is sure to be detected

Railway Schemes.—Steps are being taken by the Americans interested in railways terminating in Boston, to consolidate several lines into a through system with a terminus at some point on the St. Lawrence west of Ogdensburg, there to connect with feeders from the West and the lumber regions of Canada. As this plan necessitates the building of a bridge over the St Lawrence, we notice that the Kingston *Whig* is pointing out the advantage of crossing the river from Cape Vincent to Wolfe Island, and thence to Kingston A far better plan would be to connect the roads centreing at Ogdensburg with the Morristown and Black River Railroad, making Morristown the American terminus, and bridging the St. Lawrence from island to island a short distance above Brockville, where the river is, comparatively speaking, both narrow and shallow, and where the numerous islands could be utilized as piers, thus reducing the cost of construction to a tithe of what it would be at Kingston At Brockville a connection would be made with the Grand Trunk and with the Brockville and Ottawa, (which will undoubtedly be extended to Pembroke) and by this means the lumber trade of Canada with the Eastern American markets would pass into the hands of the combination. Let the business men of Brockville make a push in the matter and immediately communicate with the principal railroad men of Boston and the Eastern States in reference to the scheme.

## SCIENTIFIC NEWS.

The British Admiralty have arranged for sending out a naturalist in each of the Polar ships. The selection of names has been left to the Royal Society Permission has not been granted for special correspondents to accompany the expedition.

Among the items of extraordinary expenditure in the German Budget 26,000,000 marks are devoted to railway works, and 25,000,000 to the construction of canals, whereby the State wishes to help in reviving those branches of industry which are at present depressed.

Destruction to Matches.—The Paris correspondent of the London *Daily News* writes.—I have just been shown a simple apparatus which will probably sweep away ere long the match trade. It is called the electrical tinder-box, and is small enough to be carried in a cigar case. On opening this box you see a platinum wire stretched across. Touching a spring, the wire reddens sufficiently to light a cigar. At will you can introduce into a tiny sconce a mesh of cotton steeped in spirits of wine or petroleum, which, taking fire, does service as a *veilleuse*, or nurse's lamp. The hidden agency which heats the wire is a very small electrical battery, set in action by the touching of the spring. The trade price of the "electrical tinder-box" will be half a franc, or fivepence. Its inventor promises that it will be an economical substitute for the lucifer match. This apparatus may, perhaps, derange the budget, which depends for a heavy sum upon the match-tax and monopoly.

M. Violle considers that the emissive power of the sun at a given point on its surface will be the relation between the intensity of the radiation emitted at such point and the intensity of radiation which a body, having an emissive power equal to unity and carried to the temperature of the sun at the considered point, would possess. So that he defines the true temperature of the sun as the temperature which a body of the same apparent diameter as the sun should possess in order that this body having an emissive power equal to the average of the solar surface may emit, in the same period, the same quantity of heat as the sun. From experiments made at different altitudes, M. Violle determines the intensity of the solar radiation, as weakened by passage through the atmosphere, and finds, for the effective temperature of the sun, 2822 deg. Fah. Investigations conducted with an actinometer by the dynamic method lead the investigator to conclude that steel, as it emerges from a Siemens Martin furnace, has a temperature of 2732 deg. Fah. If it be admitted that the average emissive power of the sun is sensibly equal to that of steel in a state of fusion, determined under like conditions, it appears that the mean true temperature of the solar surface is about 3632 deg. Fah.

A process for producing a green bronze on iron, devised by Paul Weiskopf, is given by *Dingler's Journal* as follows :—One part of sylvate of silver is dissolved in 20 parts of oil of lavender, forming a sort of varnish, which imparts a beautiful and permanent green bronze appearance to cast and wrought iron, sheet iron, and wire. The surface to be bronzed is cleansed and dried, but need not be polished. The varnish is thinly applied with a camel's hair brush, and the object heated quickly to 300 deg. Fah. The proper temperature is indicated when the article shows a bright green colour, which is even all over it. To produce a bronze drawing, Venetian turpentine or colophonium solution is substituted for part of the lavender oil. It is better to rub up the dry sylvate of silver with resin in a mortar or on a palette, and then add enough lavender oil to make it as thin as ordinary paint. Articles of iron bronzed in this way can afterwards be electro-plated, the copper not being deposited on the portions bronzed. Copper and brass coated with this bronzing, and heated to 480 deg. Fah., acquire a matt grey exterior, which is somewhat reddish, and not permanent until covered with a thin coat of varnish, when it ressembles the so-called oxidised metal. We may add that sylvic acid is one of the constituents of ordinary resin or colophonium, and differs from pinic acid in being soluble only in hot alcohol, from which it crystallises in colourless plates. To prepare sylvic acid, the resin is first treated with cold alcohol to dissolve the pinic acid, the residue is dissolved in hot alcohol, and allowed to crystallise. Carbonate or acetate of silver dissolves in sylvic acid, forming sylvate of silver.

Many experiments, says *Nature*, have been tried in France to test the effects of cold on railway axles. Many engineers suppose that accidents to wheels do not result from any diminution of tenacity of the metal but merely from the road losing all its elasticity owing to the frost hardening the surface of the earth A fact which can be adduced as a strong argument in favour of that theory was observed by the inhabitants of Montmartre during the last period of frost. The passing of the trains which run so frequently through the Batignolles tunnel at a distance of half a mile was heard by them day and night, which is never the case in ordinary circumstances. As soon as the thaw set in the trains ceased to be heard; the earth having resumed its former elasticity, the sounds were dissipated as before. It has been observed by French railway engineers that thaws are apt to lead to the breaking of axles and chains. The elasticity being only partially recovered, many shocks affect the trains when running at a fast rate, and are apt to lead to catastrophes.

Aluminium for Engineering Instruments.—Mr. S. B Clevenger recommends the use of aluminium for engineers' instruments, its great recommendation being that an equal bulk weighs but one-fifth as much as brass, an ordinary transit weighing but 3 lb. in aluminium, and within the limits of practicable weight such instruments could be made very much larger and more accurate than in any other metal. Aluminium costs about half as much per pound as silver, and does not rust or tarnish so easily as brass It combines the ductility and malleability of copper with vastly more than the strength of steel (it is placed by some as thirteen times stronger), and the lightness of chalk.

Cutting Steel Rails Cold.—The cutting of a file in halves with soft iron was an old lecture experiment. The soft iron formed a disc about 6in. in diameter, mounted on a lathe spindle, and run at about 2000 revolutions per minute. A file held to the edge of the disc was cut in two in about ten or fifteen seconds, the disc being unharmed. The shower of sparks rendered this a brillant experiment, very popular with a general audience. The principle involved is now being applied to a practical purpose. Mr. Charles White, manager, Sir J. Brown and Co's Works, Sheffield, has found the cost of cutting off the ends of steel rails cold in the ordinary way so enormous that he resolved to try another expedient. For experiment. he last week had an ordinary rail saw put in the lathe and all the teeth cut off. The revolving disc was then mounted on a spindle and driven at nearly 3000 revolutions a minute. The disc was 3ft. in diameter, so that its circumferential velocity was about 27,000ft, or over five miles a minute, or 300 miles an hour Steel rails forced against the edge of this disc were easily cut through in three or four minutes each. The rails weighed 65lb. to the yard. Sparks flew in abundance, and the disc appeared to melt the rail before it; but after cutting five rails the disc itself was not sensibly warm. The experiment was such a complete success that the firm intend putting up a very powerful saw for the purpose of cutting cold steel rails.

The Philadelphia *North American* says. The through railroad scheme from Boston to Pittsburg and Philadelphia, *via* Poughkeepsie, and a new bridge across the Hudson river, makes steady progress in favour in business circles in Boston, and appears now likely to go through. All that is asked of Boston to insure the work is a subscription of about half a million of dollars, which ought to be obtained there with ease. The most attractive feature in the programme to the New England mind is the direct access to the coal and iron of Pennsylvania, which to the manufacturers of the Eastern States is a matter of very great importance. But this is the first through line of railroad that has come directly to the door of Boston with proposals for a permanent connection. To Boston it means Western trade as well as Pennsylvania raw materials. It will certainly throw a large amount of valuable business in merchandise and passengers upon the whole of the railroads in the State. The railway connections in New England required for this through arrangement are all in existence, and the missing link is near the Hudson.

Composition of Wool Grease —According to Schulze and Urich, the bulk of the natural wool grease of sheep consists of compound ethers. A part of alcohols and fatty acids are in a free condition.

MISCELLANEA.

A recent number of the *Deutsche Chemische Gesellschaft* informs us that a certain chemist has studied *orthoamidor resylparasulphurous* acid, and that by the aid of hydrochloric acid and chlorate of potash he has transformed it into *trichlororthotoluquinone*. Further on the author discourses on *nitrorthocresylol-parasulphurous* acid, and finally some other chemist hurls at us the fearful jaw-paralyser—nitrate of *ethenyldenitrophenyldiamine*. There are plenty more examples of this kind before us, but we spare the reader.

According to an uncontradicted statement in the St. Petersburg journal *Lis'ok*, the Shah of Persia has given one Herr Falkenhagen, a Russian subject, a concession to construct a railway from Tabris to the Russian frontier. If this line is carried out, it will be extended to Tiflis, and will become the first railway connecting Asia and Europe.

A novelty in connection with free passes on railways has just been started by the Pennsylvania Company. On the back of the pass is a photograph the "dead head," as people who are allowed to travel without payment are kindly nicknamed.

One reason why oatmeal is not more generally used as food is that, in the way in which it is usually cooked, it requires constant stirring, which takes a good deal of time and attention. If, after the porridge is mixed, that is, as soon as the oatmeal is stirred into the boiling water, the cover is put on and the tin saucepan containing it placed in another pot of boiling water on the stove, and the water let boil, good oatmeal porridge will be made, without the least danger of its being scorched.

A New Sphere for the "Great Eastern—Private letters from America announce that the proprietors of the *Great Eastern* are engaged in discussing a most extraordinary proposal. The great ship, it is said, is to be anchored in Philadelphia Harbour during the Centennial Exhibition, and to be made a great floating hotel, where 5000 persons can be comfortably accommodated.

The Ostrich Outdone.—Formerly a case such as that recently recorded of the insane cobbler, who swallowed a pretty complete sample of the implements of his craft, would have lasted medical writers for half a century. In such a way the ancient example of the Frenchman who bolted a knife was quoted, re-quoted, and quoted again, until the reading public were as sick of the example as the Frenchman might well be of the knife. But now-a-days there is not the same necessity for repetition in the recital of any kind of eccentricity. The latest case is that of a lady in New York, who, in December last, swallowed a silver dental plate with four teeth attached, and has been, in consequence, living upon spoon meat until the other day, when the plate and teeth were removed by a species of Caesarean operation. In this instance, however, it was not morbid appetite, but an accident which displaced the lady's teeth and palate. Inspired by the case of fork-swallowing in Paris, in April last, Dr. Mignon has collected the details of 163 similar instances of the wilful or accidental swallowing of metallic substances and others equally indigestible. Among these we find fifteen gold medals, hair rings innumerable, 175 fr., a shoe buckle, nine inches of a sword blade, very sharp scissors, eighty pins, a baby's bottle the castor of a night-stool, an entire set of dominoes (the size of which, however, is not stated,) 100 *louis d'or*, a flute four inches long, a glass phial, thirty-five knives, a clay pipe, from 1400 to 1500 pins, a bar of lead weighing a pound, a whetstone, and (in three instances) a table fork But the most extraordinary of all these cases occurred in the instance of a convict who died at Brest, and on whose body a necropsy was performed. The stomach was completely displaced, and occupied the left hypochondrium, the lumbar and iliac regions of the one side extending into the pelvis nearly as far as the foramen ovale, it contained fifty two different objects, weighing altogether 1 lb 10 oz. Among them was a part of the hoop of a barrel, 19 inches long and 1 in wide. It is remarkable that out of all these cases only twelve had a fatal termination, two of them probably in consequence of the operation by which the foreign body was removed. Gastrotomy was employed in five instances, the object extracted in one being a bar of lead 10 inches long and weighing a pound; the other a similar bar, 9 oz. in weight and nearly a foot long.

THE PLUMPING MILL.

## THE PRIMITIVE PLUMPING MILL.

It is interesting often to look away from the highly-finished products of modern mechanical science back to the rude implements not only of our forefathers but of those who now, far removed from centres of civilization, live much as our progenitors of generations back lived. An instance of this is found in the primitive machine we illustrate above. We are indebted for the illustration to the *American Agriculturist*, in whose columns the machine is described as follows:

"The early settlers in this country who had no mills, as as well as the pioneers of the present day, who are at a great distance from them, were, and still are, obliged to resort to various expedients to bring Indian corn, their chief and generally only grain, into an eatable condition. Perhaps the simplest method of preparing the grain, is to make what is known as hulled corn, the corn is boiled in lye from wood ashes, until the hull or skin of the grain readily separates; it is then washed and stirred to remove the hulls, soaked in successive waters to remove all traces of the lye, and then boiled until tender. Even at the present day the Mexican peasantry prepare their corn in a similar manner; they remove the hull by the use of lye, and then instead of boiling the grain, they grind it to a paste on a stone called a *metate*, which is the chief article of furniture in every Mexican kitchen, (which usually includes parlor and bed-room;) this is a slab of hard stone, about a foot wide, and two feet long, elevated at one end by legs. The soaked grain is placed upon this, and by the use of a sort of stone rolling-pin moved briskly up and down, it is ground to a paste; this is then patted out into a thin cake, and quickly baked upon an earthen or iron plate, beneath which are live coals. These cakes are called *tortillas*, and are the staple bread all over the country; they are sometimes made of wheat, but generally of corn. This method of using corn is purely Mexican, and no doubt derived by the Spanish settlers from the aborigines. While hulled corn is pleasant as a variety, and is at the present day sold in New England towns as a luxury, it becomes very tiresome as a regular food, and a poor substitute for corn cakes or bread made from meal. To obtain meal when a grist mill could only be reached by long journeys through the woods, over roads that were little more than foot-paths, or by a long voyage in a canoe or dug-out, the early settlers had recourse to the simple contrivance shown in the engraving. This is called the plumping mill, (*plump* to fall suddenly or with violence,") and is made by burning and digging out a cavity in a hard wood stump, until a rude mortar is formed, then a long and heavy pestle, made also of hard wood, is attached to a long spring pole, and thus is formed a rude machine to be worked by one-man power A slow and tedious method of obtaining meal, but one which many hardy pioneers have been content to follow until a better way could be found. It is a curious fact that the first patent granted in England, to the specifications of which drawings were attached, was for a kind of compound plumping mill, to be worked by horse or water-power, though some might find still more curious the fact that this invention was made by a woman. We have seen a copy of the original drawing at the Patent Office in Washington, which shows a row of 5 to 12 mortars, according to the kind of power used, the pestles were worked by a revolving shaft, the teeth upon which lifted the pestles and let them fall The patent was granted in 1715, to "Thomas Masters, of Pensilvania, Planter, his Execrs, Admrs, and Assignees, of the Sole Use and Benefit of A New Invencon, found out by Sybilla his Wife, for the Clearing and Curing the Indian Corn Growing in the Severall Colonies in America, etc."

MODERN GHOST-RAISING. A SKETCH BEHIND THE SCENES AT THE POLYTECHNIC, LONDON, ENG.

## PUNCTUALITY

*(John Bull)*

"*La Ponctualité c'est la Politesse des Rois*" is an old axiom, and one which, it must be confessed the Kings and Princes of the earth have laid well to heart. Her Majesty's exactitude as to time is proverbial; and her sons and daughters are little behind her in this respect. We wish the good example set them exercised a more marked effect on Her Majesty's subjects, and that they would sometimes reflect on the extreme discourtesy which their disregard of it causes them to show to their friends and entertainers. Given any person, man or woman, in even moderately good health, no excuse which can be framed, no matter how ingeneously, can for one moment hold water in excusing chronic unpunctuality. Every one, not afflicted by illness, can be punctual if they choose; it is the will that is wanting, not the power. A proof of this is that people can always manage to be in time if they are quite certain they cannot get what they want without being so; it is only when the convenience of others is in question that they give themselves a most irritating latitude. Everyone knows the impossibility of inducing dinner guests to make their appearance within any reasonable period of the time named for their arrival. Let them once be fully aware that, as is the case in one or two—alas! only in one or two—very great houses, no guest, whatever his or her rank (Royalty, of course, excepted), is allowed more than ten minutes' "law," and the most illbred and *insouciant* dandy, the most feather-brained fine lady who thinks it gives her importance to make everyone else uncomfortable, at once finds it convenient to arrive punctually to the hour named. As a general rule it may be assumed that it is only the utterly idle who are ever late. If a man apologises for his unpunctuatility by saying, "he was so busy," be sure he was leaning over the rails in the Park. People who have anything really to do are far too well aware of the value of time to waste either their own or that of those with whom they come in contact. It is not they who make an appointment with a busy man at eleven in the morning and saunter in, looking blissfully unaware of their unpunctuality, at half-past twelve. No; the man who does this has generally been at his wits' end to kill time all the morning; but he preferred a cigar, or a visit to his stables, and his own pleasure was of far more consequence than a busy man's time; or else he fancied being late made him of some importance. This latter feel- is very frequently indeed at the bottom of feminine want of punctuality. "Oh! they must wait for a lady," we have heard said, quite gravely, as the reason for a speaker coming in from her drive just at the hour when, fully dressed, she should have been stepping into her carriage to go out to dinner.

It may be thought frivolous to insist so much on this unpunctuality for dinner; but, apart from the annoyance and discomfort it creates, and its excessive bad taste and impertinence, it is only a sign of the general habit of life. Any one habitually and deliberately unpunctual for dinner is tolerably sure to be irregular in all the other events of the day, and, besides the terrible amount of time wasted, the household conducted on such principles can never be an orderly one. If servants find that masters and mistresses never keep to time, it can hardly be expected that they will be more particular, there is soon no settled time for anything, and every one does as seems good in their own eyes. To children also unpunctuality is most deleterious, both physically and morally—physically, because their juvenile constitutions require stated food at stated hours, and are sorely tried by prolonged waiting, morally, because it requires infinitely more mental ballast than they can be expected to possess to keep steadily to work when they never know exactly when it will be called for. Perhaps there is nothing so profoundly irritating to an unpunctual person, who more frequently than not keeps up the farce of professing to believe that he or she is the most punctual of mortals except on the one occasion in question, as to come down in a storm of apologies, "Oh, dear! I hope I'm not late," &c., and to find the person kept waiting, dressed and ready, and employed calmly with book or work, as one used to waiting. "You need hardly have settled yourself; you knew I should not be a minute," says the delinquent, with a injured air, blithely ignoring the fact that the horses have been fretting at the door half an hour by the clock. This is a common phase, but others take a more plaintive line: "How I envy you always being in time! I couldn't be punctual if I tried. I never had any idea of time." Now this is sheer and arrant nonsense, and as such should be instantly and uncompromisingly snubbed by any one to whom it is addressed. Every one can be in time if they choose, and even those unprovided with watches might, if they gave their minds to it, make such use of neighbouring clocks as to at least improve greatly on their present bad habits. But that would involve trouble and thought for others, and they are of all things the most repugnant to the soul of the unpunctual. Self-indulgence is their idol, and not all the professions of penitence which they from time to time think it expedient to make simply the faintest intention of abandoning its worship. A very great deal may be done by parents in nipping the vice in the bud. When the offender discovers that he (or she) is never waited for, that everything goes on as usual, that on appearing late at a meal no dish is ever recalled, but that he must take his chance of what happens to be left, that parties of pleasure start at the appointed time, irrespective of his appearance or the reverse, he will begin to discover that it is as well to form habits of punctuality, and, once formed, they are hard to break. We only wish we could venture to hope that the world would follow the same plan, and utterly disregard the comfort of those whose vanity, impertinence, and bad taste lead them, to keep others waiting for no object but their own selfish gratification; but we fear that so-called "good-nature" is too strong for our hopes to be realized. The world seems to forget that in being "good-natured" to the offenders it is thoughtless of the sufferers.

## CURIOUS INCIDENT OF A RETRIEVER.

A very curious incident lately occurred to a retriever of Mr. Higgs, of Southampton. It being a case of great interest to veterinary surgeons, as well as all owners of dogs, I venture to give it *in extenso*. The dog, a great favourite and perfect in his business, was usually kept chained to a wooden kennel for safety, Mr. Higgs passing much of his time in the town. On his return home he always visited his dog. For two or three days in succession he remarked that the animal had a sullen, sulky look, and instead of receiving him with his accustomed joy, neither held up his head nor affected to recognise him. On his entering his house shortly after this suspicious behaviour, his daughters informed him that the dog had all day snapped and howled in a most peculiar manner, and that he had bitten and torn his kennel unceasingly, and would not be quieted. Upon inspection, Mr. Higgs found such to be the case, and that the countenance of the dog was anxious and alarming. Hydrophobia, and the best remedy for such a threatening malady, the gun, naturally presented itself as his surest safety. However, as from the arrangement of the premises and the locality of the kennel, it was impossible under any circumstance, that harm to others could come of his being allowed to live, after due caution to all his household, he determined to "see it out." Day after day passed with no new feature in the case: the dog literally tore his kennel to pieces, to shreds, making matchwood of it, and from this time he chained him to the wall. Upon a closer examination of the poor beast, Mr. Higgs perceived that there was a considerable swelling of the right side, commencing at the lower rib, and extending upwards towards the shoulder. He had now some hopes of reasonably accounting for the evident torture of his dog, yet strange to relate, there was throughout no loss of appetite, and he well supplied him with water, of which he drank freely. His attention from hence was completely attracted to the supposed tumour, which he soon had the satisfaction of seeing daily increase, and that to an almost incredible extent. He did not venture to handle him, the symptoms of restless, savage sulkiness still being expressed. To his great satisfaction, however, one morning the swelling had burst and disappeared, and he found his favourite licking away at what appeared to be a great hole in his side, and sufficiently relieved to faintly welcome his master. The day after this, with the assistance of a friend a more minute inspection of the wound was made with the object of fomentation and dressing it. Whilst thus engaged a foreign substance was discovered in the centre of it, which presented a firm and pointed front, and which evidently proceeded from the intestines of the dog. This, clearly, to their minds the cause of all the mischief and suffering they determined to attempt to remove. First well securing the dog's head and then getting a firm hold of the obstacle, his friend, using considerable force, succeeded in drawing out, when, to their inexpressive astonishment, behold, he held in his hand a galvanised iron skewer, such a one as is in ordinary use for trussing and roasting fowls, six inches long, with a loop at the top. It had, of course, been thrown to him amongst the scraps from the kitchen, and no doubt he had "wolfed it." In three or four days after the above operation, the retriever was quite well and in his usual health and spirits.

## BUYING A HORSE.

The following hints on examining a horse appear in *The Maryland Farmer*. They contain much good advice to the non-professional dealer, but fail to cover all the defects a horse may possess. But the chances are that the purchaser who gets a horse free from every defect herein enumerated will have a pretty sound animal.

Examine the eyes in the stable, then in the light; if they are in any degree defective, reject.

Examine the teeth to determine the age.

Examine the poll or crown of the head, and the withers, or top of the shoulders, as the former is the seat of poll evil, and the latter that of fistula.

Examine the front feet, and if the frog has fallen, or settled down between the heels of the shoes, and the heels are contracted, reject him, as he, if not already lame, is liable to become so at any moment.

Next observe the knees and ankles of the horse you desire to purchase, and, if cocked, you may be sure that it is the result of the displacement of the internal organs of the foot a consequence of neglect of the form of the foot, and injudicious shoeing.

Examine for interfering, from the ankle to the knees, and if it proves that he cuts the knee, or the leg between the knee and the ankle, or the latter badly, reject.

"Speedy cuts" of the knee and leg are most serious in their effects. Many trotting horses, which would be of great value were it not for this single defect, are by it rendered valueless.

Carefully examine the hoofs for cracks, as jockeys have acquired great skill in concealing cracks in the hoofs If cracks are observable in any degree, reject. Also both look and feel for ringbones, which are callosities on the bones of the pastern near the foot; if apparent, reject.

Examine the hind feet for the same defects of the foot and ankle that we have named in connection with the front foot. Then proceed to the hock, which is the seat of curb, and both bone and blood spavins.

The former is a bony enlargement of the posterior and lower portion of the hock joint; the second a bony excrescence on the lower, inner, and rather anterior portion of the hock; and the last is a soft enlargement of the synovial membrane on the inner and upper portion of the back They are either of them sufficient reason for rejecting.

See that the horse stands with the front feet well under him, and observe both the heels of the feet and shoes to see if he "forges" or overreaches; and in case he does, and the toes of the front feet are low, the heels high, and the heels of the front shoes a good thickness, and the toes of the hind feet are of no proper length, reject him; for if he still overreaches with his feet in the condition described, he is incurable. If he props out both from feet, or points them alternately, reject.

In testing the driving qualities, take the reins while on the ground, invite the owner to get in the vehicle first, then drive yourself. Avoid the display or the use of the whip; and if he has not sufficient spirit to exhibit his best speed without it, reject. Should he drive satisfactorily without, it will then be proper to test his amiability and the extent of his training in the use of the whip.

Thoroughly test his walking qualities first, as that gait is more important in the horse of all work than great trotting speed. The value of a horse, safe for all purposes without blinds, is greatly enhanced thereby.

Purchase of the breeder of the horse if practicable; the reasons are obvious.

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The Philadelphia and Reading Railroad Company have commenced the use of petroleum gas on their cars.

## SHRINKING OF SEASONED TIMBER.

The various kinds of oak, and some other kinds of valuable timber, will shrink more or less every time the surface is dressed off even a small fraction of an inch. Wheelwrights, accustomed to work in oak, are well aware of this fact, and a correct appreciation of it often enables them to turn out work of a superior character, even of ordinary materials, by first blocking out the pieces roughly, then allowing the timber to season, and afterwards working the various parts by degrees, as the seasoning process becomes more and more complete. White oak spoke timber, for example, may be allowed to remain in rough state for half a score of years, under shelter, without becoming seasoned so thoroughly that the timber will not shrink after the spokes have been dressed out.

Carriage-wheels have often been made of the choicest of oak timber after every spoke had been seasoned for several years, and, to the great surprise of the wheelwright, every spoke would work in the joints before the vehicle had run three months. The defect in such instances could not be attributed to inferior timber, nor to perfunctory workmanship. but simply to this one circumstance—that the parts of the wheels were put together before the timber had ceased to shrink.

To prove that the best quality of oak will shrink, after a spoke has been dressed out, let a tenon be made on one end, and be driven immediately into a mortise, after a few days' exposure in a warm workshop the spoke may be withdrawn with little difficulty. The same fact will hold good in the manufacture of woodwork of any kind where oak is employed for tenons. In order to make joints that will never start, the piece on which the tenons are to be made should be dressed over several times, until the shrinking has ceased. Then let the tenons be made. After these have shrunk, while exposed to the drying influences of a warm workshop, the spokes, or other parts, may be driven into their respective places, with the assurance (especially if they are dipped in oil paint previous to driving) that the timber will shrink no more.

Many kinds of farming implements, in the manufacture of which oak and ash are employed, render very unsatisfactory service, simply because the seasoned timber was not allowed to shrink before the tenons were driven into the mortises. In like manner, oak chairs, and other oak furniture, will frequently shrink to such an extent that the pommels, rungs, dowel-pins and banisters will all work loose, if the precaution we have described is not observed.—*American Builder*.

## EXPERIMENTS ON FLOWERS.

The *Journal de la Société Centrale d'Horticulture de France* contains some interesting particulars on the artificial colouring of natural flowers. Those that have a violet hue will gradually change colour and turn to green under the influence of the smoke of a cigar. This is easily seen, for instance, on the petals of *Thlaspi* or shepherd's purse, *Iberis umbellata* or *Hesperis matronalis*. This change is owing to the ammonia contained in tobacco, starting from this circumstance, the Italian professor, L. Gabba, has made a series of experiments on a variety of plants with that alkali in its natural state. His apparatus is a very simple one, merely consisting in a plate into which he pours liquid ammonia, covering it afterwards with a reversed glass funnel. The flower to be tested is inserted into the tube. In this way he has seen violet, blue, and purple turn to bright green, intense carmine red (of the pink) become black, white turn yellow, &c. The most extraordinary results were afforded by variegated flowers. When the latter, immediately after this exposure, are dipped into pure water, they will retain their new colours for several hours, after which they simply return to their former state. Another curious discovery of Professor Gabba's is, that the flowers of aster, or starwort, that are violet and have no smell, acquire a delightful fragrance and turn red under the influence of ammonia. We know that the Japanese, by means of injections which they keep secret, can colour or whiten flowers and obtain wonderful variegation The Chinese have also secrets of their own, among which one for reducing large trees to a dwarf size. The Garden of Acclimatisation has at this moment an orange tree, a hundred years old, and imported from China, no bigger than a rose tree, its fruit scarcely attains the size of a cherry.

TRANSPORTING MERCHANDISE IN EASTERN TURKESTAN