MEDIÆVAL IRONWORK.

The accompanying engraving shows a beautiful specimen of the renowned wrought ironwork of the middle ages. It is a lattice or grille for a window, and is a graceful and elaborate piece of work, wrought out entirely with the hand hammer. It is of German workmanship. and is to be seen at Botzen, a city of the Tyrol, one of those ancient cities to whose workmen we moderns are indebted for countless examples of what skill and taste can doin making our homes, churches, and streets beautiful, and the influence of whose works is now to be found in all parts of the earth.

Improved Hospital Construction.

We are indebted to Mr. John R. Niernsée, a well known architect of Baltimore, Md., for copies of sketches of various descriptions of wards suggested by him for the John Hopkins Hospital, in the above named city; also for a copy of his own review of the various complete plans submitted for the construction of that institution. In the sketches, the adjuncts of the wards are isolated from the latter by placing a connecting closed corridor between them in the basement only. The isolating vestibule connecting the buildings on the main floor has ventilation of its own, thus preventing any contaminating intermixture of air currents. By this system the architect proposes to obtain virtually all the advantages of the detached pavilion system of the lately completed great hospital in the city of Berlin, Prussia. The drawings exhibit five differently shaped common wards, with diverse arrangements of their adjuncts or service buildings, but all based on the principle of effectual isolation of the common ward.

The New Thames Tunnel.

The new subway between North and South Woolwich, which was lately commenced in London, is estimated to cost $375,000, and will consist of an iron tube in segments 9 feet high, with a breadth sufficient for four adults to walk abreast. It will be lined with white glazed pantiles and be lighted with gas, and will possess an efficient system of ventilation. The entrance at the south side of the Thames will adjoin the North Woolwich station of the Great Eastern Railway, and on the north side will adjoin the Woolwich pier. The charge to casual passengers will be two cents each way, but to workmen going to and fro books of tickets will be issued at a considerably reduced rate. The new tunnel is being constructed chiefly for the accommodation of the workmen engaged at the St. Katherine's Dock Extension Works, where 3,000 men will be employed for three or four years to come, the Beckton Gas Works, where 2,000 stokers are at work, Henley's telegraph works, Silver's india rubber works, Foster's wine stores,etc., numbering altogether some 8,000 men, who at present have little or no house or food accommodation within easy access of their work, North Woolwich being a dismal swamp unsuited for residential purposes. The new docks, which will materially increase the dock accommodation of the Port of London, will reclaim twenty acres of marsh land, and convert North Woolwich into a comparatively healthy island.

Liquid for High Temperatures.

It is often necessary to surround the pipes of heating or evaporation apparatus, and hot air apparatus, ovens, stoves, etc., with a boiling liquid at a temperature above 212° Fah.; it is also necessary to make use of water baths producing high temperatures. The liquid employed for this purpose is simply water in which sea salt has been dissolved. Oil baths, etc., are also used. Messrs. Grimm and Corvin propose, instead of these various agents, to make a solution of chloride of lime in glycerin, a solution which does not boil below 572 or 626° Fah., and has the further advantages of never attacking metals nor congealing.

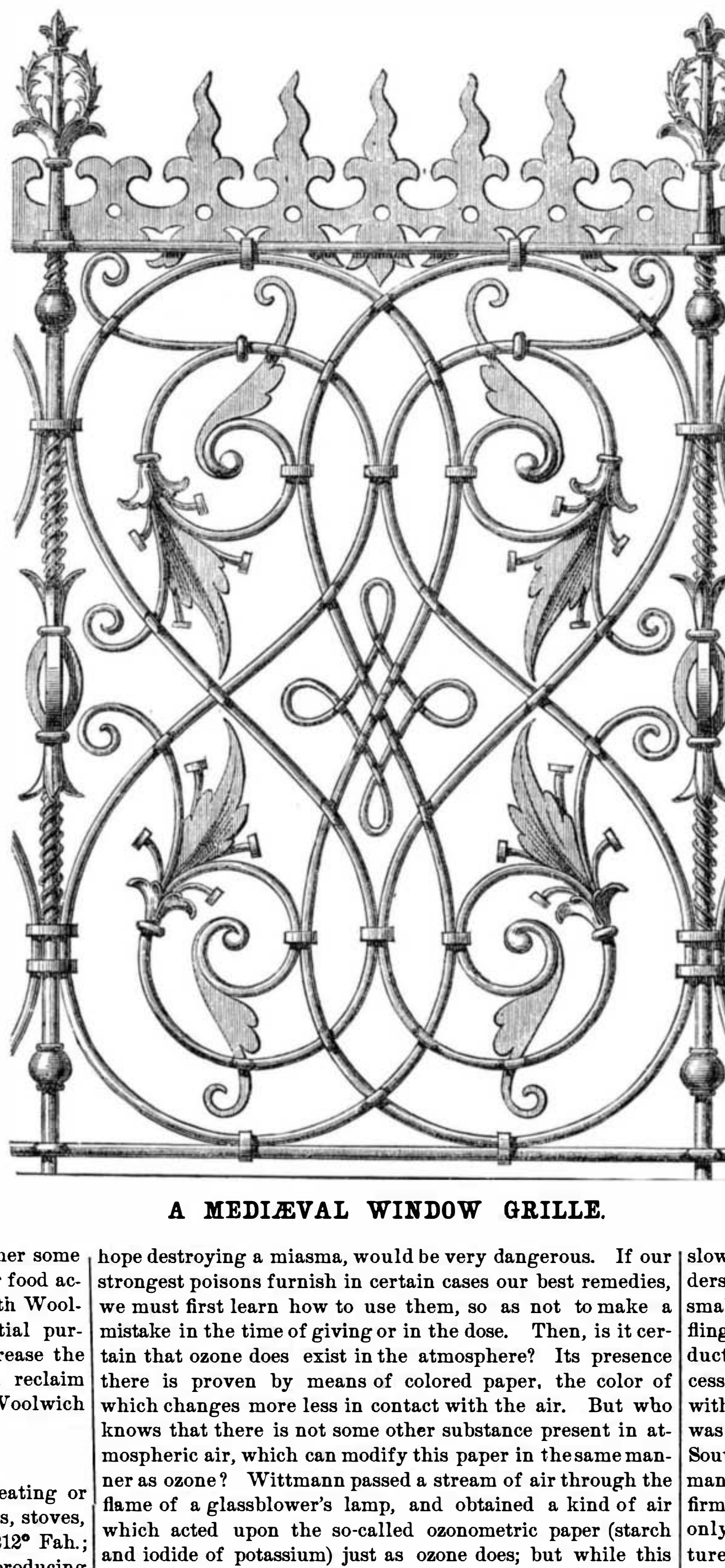
Manufacture of Clouds.

The stage of Wagner's theater, at Bayreuth, required 3,247 gas jets. The rising mists and gathering clouds needed for scenic effects were produced by two large engines placed at a short distance from the theater, whose steam was carried by pipes to reservoir, from which it could be distributed by a network of tubes over the whole stage. In the corner towers of the theater are two cisterns, each holding about 1,200 gallons, from which water can be obtained at a very high pressure in case of need. The gas and water works of the theater have cost $30,000.

Ozone an Active Poison.

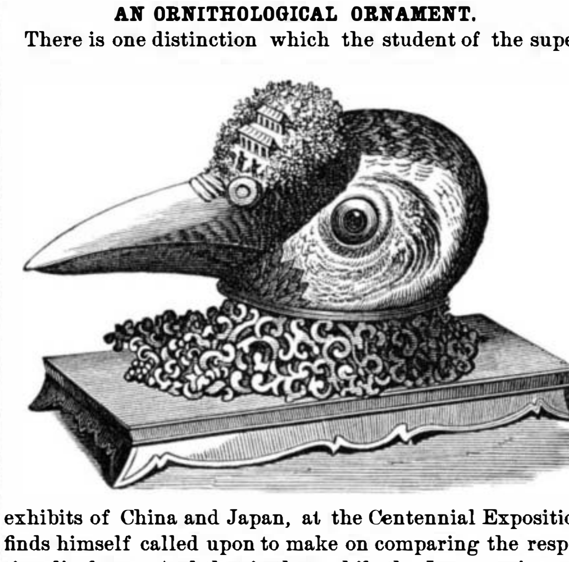
The eminent French chemist P. Thénard writes as follows in regard to the effect of ozone, or active oxygen, on the animal system. "I believe," says he, "that it is high time that the attention of the public, and even of the learned, was directed to the widely spread errors in regard to the action of ozone on the system. Far from being a remedy, it is rather one of the most energetic poisons that has been prepared in our laboratories, and the serious accidents which have occurred in my own leave no doubt of it. I will not enlarge on its physiological action, since A. Thenard will soon publish an article on that subject; but will only give prominence to the fact that, under the influence of ozone, even when greatly diluted, the blood corpuscles rapidly contract and change their form, the pulse become slower, so much so that a guinea pig with a normal pulse of 148, after being kept 15 minutes in a weak ozone atmosphere, had the pulse reduced to one thirtieth. At the present time, when an accurate method of measuring temperature is of great assistance in medicine, ozone may possibly prove a means of preventing too great a rise of temperature; but inconsiderately to disseminate ozone in inhabited places, in the delusive hope destroying a miasma, would be very dangerous. If our strongest poisons furnish in certain cases our best remedies, we must first learn how to use them, so as not to make a mistake in the time of giving or in the dose. Then, is it certain that ozone does exist in the atmosphere? Its presence there is proven by means of colored paper, the color of which changes more less in contact with the air. But who knows that there is not some other substance present in atmospheric air, which can modify this paper in the same manner as ozone? Wittmann passed a stream of air through the flame of a glassblower's lamp, and obtained a kind of air which acted upon the so-called ozonometric paper (starch and iodide of potassium) just as ozone does; but while this air disinfected badly smelling water without making it acid, ozone does not disinfect and does make it acid. Moreover, it is well known that ozone cannot exist at a temperature of 392° Fah. (200° C.), while this modified air of Wittmann's was exposed to a temperature at which glass softens."

It will be seen that there is still much to be desired in the discussion of this question, although it would be considered over-hasty to deny the possible presence of ozone in the air, or to assert that it is never used with profit in medicine.



A MEDIÆVAL WINDOW GRILLE.

AN ORNITHOLOGICAL ORNAMENT.



There is one distinction which the student of the superb exhibits of China and Japan, at the Centennial Exposition, finds himself called upon to make on comparing the respective displays. And that is that: while the Japanese impress us by their remarkable progress, by the wonderful celerity with which they are adapting themselves to Western ideas, habits, and customs, and with the admirable neatness and artistic beauty of their handiwork: still one may look in vain for the evidences of that tireless patience which, reinforced by skill transmitted from father to son for ages, results in the production of the marvelous work in ivory, in wood, and in porcelain, which abounds in the Chinese department. The Japanese bronzes exhibit the perfection of delicate labor; the Chinese carved wood ornaments show the same characteristic, but in addition indicate labor carried on over very long periods of time. The essential feature of every thing Japanese is ingenuity and skill; of everything Chinese, patience; and nowhere throughout the Chinese exhibit is this last characteristic more prominently displayed than in the case of ivory goods in which the curious ornament represented in the annexed engraving is found.

In this case are the famous Chinese balls—hollow sphere after sphere being carved one within the other out of a solid lump of ivory, and yet each sphere is exquisitely carved and ornamented. Here also are superb sets of ivory chessmen, valued at over four hundred dollars per set; models of Chinese junks with every portion a marvel of delicate filagree work; fans reminding one of petrified lace and grotesque statuettes in ivory, in forms such as only originate in the Celestial mind. The ornament we illustrate is a large bird's head, the bill being made out of ivory, richly carved in groups of men, houses, and trees on its upper side. At this point also the bill is stained or rather clouded a deep red. The head proper is covered with feathers attached in some incomprehensible way, but so naturally that one would suppose, did so gorgeous a bird—not to mention a creature with an ivory beak—ever exist, that they grew there. The feathers above are of a deep peacock green; as the eye is approached, an exquisite shade of light blue is contrasted with a golden yellow, and a few light crimson feathers stand prominently forth from those of softer hue. Beneath the bill the feathers are of a rich brown flecked with black. The combination is one of surpassing beauty. The head rests on a base of ebony carved in intricate designs, and this in turn on an ornamental pedestal.

Flax Manufacture in America.

The commencement of a new manufacturing industry in this country is exemplified in the successful establishment of a small linen factory at Manchester, N. H. Some enterprising parties secured some land, sowed it to flax, gathered the crop, and prepared it for spinning, hired a Scotch flax finisher, procured spinning machinery and one loom, and worked up the flax carefully and slowly, until by easy steps the business was thoroughly understood and mastered. The amount of money risked was small, and in case of failure the loss would have been trifling. But it is precisely such ventures as this, and so conducted, that succeed, and this experiment has become a success. A linen manufactory is about to be put into operation with a certainty of its being practicable and profitable. It was in this way that the cotton manufacture began in the Southern States, where it is now a grand success. Woolen manufacture began similarly in the West, where it is now firmly established, and we are well convinced that it needs only to be begun in this careful manner for flax manufacture to become also an established business in the West.—*Bulletin of the American Iron and Steel Industry.*

Jacquard, the Inventor of the Figure Loom.

The Italian proverb, *chi dura, vinc*, is so true that the world has often had to lament the interruption of useful labors by the too early death of those who have begun them; the projector fails, and his half-executed projects fall back into formlessness. Jacquard, tried by fortune with a severity exceptional in the history of inventors, did at least last long enough to perfect his invention and know its success. The story of his life and an historical account of his world-famous loom are contained in a handsome quarto from the pen of Dr. Kohl, lately published.

Born at Lyons in 1752, the son of a journeyman silk weaver, young Jacquard grew up without more formal education than the reading he snatched as an apprentice in a bookbinder's shop. His energetic spirit was but disciplined by his difficulties; yet to have been able to have a share in advantages, now at hand's reach of every mechanic, would have been of priceless benefit to him, and, probably enough, of advantage to ourselves, the heirs of his successes. His mother died while he was yet young; when he was twenty his father died, bequeathing him a little house and a hand loom. Jacquard quitted his bookbinding for the loom, seeing the time come to carry out his improvements in it, which he had long been revolving. He married a woman who endured many years of privation with him: their first born was not many months old before poverty came upon him; he sold his little patrimony; and destitute, with wife and child, faced about to fortune, fighting necessity with a quick brain. Inventing, contriving, improving, he fought his way on till the thirty-seventh year of his age, when the revolution broke out.

He now became a soldier in the non-figurative sense of the word, and remained in the army till 1795, when his son, a lad of sixteen, was shot down at his side. In 1796 he came back to Lyons: the shade deeper in his large, melancholy eyes, his face graven by thought and sorrow into the sad patience shown so well in his portrait. He now devoted himself to the making practicable his figure loom, hoping thereby to reduce the tediousness of the work of the children employed in the weaving shops. He received sufficient support to enable him to realize his plans, and in 1801 exhibited at Paris his inventions, which won for him a bronze medal, and were immediately taken up by the Lyons master weavers. In this, as in later inventions, Jacquard retained no right of profit.

The next sight we have of him is at Paris, where he had brought a model of a machine to compete for a prize offered for a mechanical method of making fish nets. Introduced to General Bonaparte and his adjutant Carnot, the latter roughly asked him "if he were the man who professed to do what God himself could not do?" The general came to the aid of Jacquard, and, with characteristic insight, approved both invention and inventor, dismissing the latter with encouragement to experiment further.

In 1804 the Society for the Encouragement of Industry became Jacquard's patron, and gave him a post in the *Conservatoire des Arts and Métiers*. This was perhaps the fairest part of the inventor's life, and invention after invention surprised the world with his fertility. It was in the few months that he kept his post here that he recreated Vaucanson's spinning loom. Unluckily for himself, he received and accepted an invitation from Lyons to superintend a factory there, and left Paris before he had been in it a twelve month. In 1806 the Prefect of Lyons received an imperial order to pay Jacquard a pension of $600 a year, on condition that the latter conceded to the city of Lyons all the right and profit in the use of his inventions, binding the inventor to watch over the same and give his whole time to them. The far-sighted and very capable Emperor acted exactly as many a rascally overseer in a factory does by a clever subordinate, who, at the cost of a little inexpensive distinction, is flattered out of the fruits of his brain. From this, the highest moment of his fortunes, began their decline. Public opinion in Lyons turned against him, his models were used without compensation, he engaged himself in contracts in which only his own side was kept to, his machine was slandered as a plagiarism of Vaucanson's. The weavers were accused of purposely spoiling their goods to bring the Jacquard loom into discredit; and their hatred to their benefactor, expressed in often repeated threats of murder, culminated in their breaking up and burning, in the Place Terraux, models and machinery together—scenes, the horrors of which flashed up again only too vividly when Jacquard was an old man and came to die. Only inventors and benefactors know the innermost bitterness of moments such as these.

Little by little the Jacquard loom came into universal use, and at length, in 1840, the Lyonnese, aided by foreign subscriptions, set up in honor of their great citizen a bronze statue, with the inscription:

A. JACQUARD
LA VILLE DE LYONS RECONNAISSANTE
MDCCCXL.

The inscription must have been written by a foreign satirist. Jacquard died on August 7, 1834, in the 83d year of his age.

The sketch which Dr. Kohl gives of the life of the inventor is followed by the fullest details of his inventions in the order of their development. An atlas of mechanical plates, beautifully executed, complete the very perfect monograph, to which a last interest is given by its German authorship.

Correspondence.

Rat-Tailed Larvæ.

To the Editor of the Scientific American:

I wish to call your attention to something I found recently at a neighbor's. The curiosity consists of larvæ, about $\frac{3}{4}$ inch in length and $\frac{1}{8}$ inch in diameter, of cylindrical form, having usually six feet on each side, and covered by a transparent skin through which the internal viscera can be distinctly seen; but most remarkable of all, the posterior end of the body terminates in a caudal appendage of about the same length as the body, and presenting to the eye the same appearance as the tail of a mouse or rat.

One thing that attracted the attention, of the gentleman at whose place I found these specimens, was the fact that the water in which they were found had contained the carcasses of four or five drowned rats; and when they were thrown out of the barrel in which the water was contained, the bodies of two of the rats were filled with these rat-like worms! Upon the water, which was quite stagnant and foul, were several hundreds of these larvæ, some alive and squirming and crawling up the sides of the vessel, but a majority dead; but all had the tails.

I am not much of an entomologist, but have given the science some attention; and in all my reading, and in such search as I have been able to give the matter, I can find no authority for maggots with tails like rats, which these undoubtedly are. They are new to me, although they may be familiar to you. Will you please let me know where they belong? R. M.

Emporia, Kan.

[The curious "rat-tailed" maggots, so graphically described in the above letter, are the larvæ of a large two-winged fly belonging to the genus *eristatis*.

They may be found not only in stagnant pools, but also in water-soaked rotten wood, and are quite common in salt vats. Our correspondent may rest assured that, singular as was the resemblance which struck him so forcibly, between these larvæ and the rats that were found drowned in the same vessel with them, it was a mere coincidence and not in any sense a case of mimicry or inheritance. The larvæ of *eristatis* being aquatic or amphibious, the tail-like appendage is in reality a respiratory tube, provided at the tip with two stigmata which may be protruded above the surface of the water for the purpose of inhaling air while the larva remains concealed beneath. These larvæ are further characterized by the seven pairs of well developed prolegs or leg-like tubercles: the young of no other species of *diptera* possessing so complete a set of locomotive organs. When ready to transform, they leave the water and burrow into the ground, changing to coarctate pupæ, of which the tail still forms a conspicuous part. The flies are frequently seen hovering about flowers in the spring or buzzing loudly against our windows in autumn. One species has large, bright copper-colored eyes, and a stout body of metallic green color, the thorax ornamented with five gray stripes. Some are gaily banded with black and yellow, and, except by a careful observer, might be mistaken for wasps. Others again have hairy bodies and legs, and more nearly resemble bees.—EDS.]

Expansion of Locomotive Boilers.

To the Editor of the Scientific American:

I notice that some builders of locomotives still persist in fixing the side bars or framing of their engines rigidly to the boiler, notwithstanding their knowledge of the expansive qualities of metals. Under ordinary changes of the weather, all iron structures of much extent, if designed for durability, must have provision for easy play of this resistless and ceaseless action caused by change of temperature. How much more important is it that careful provision should be made for the free expansion and contraction of a locomotive boiler, subject as it is to vastly greater changes of temperature!

It has been found by experiment that the quality and condition of a metal determines the percentage of its expansion. For instance, tempered steel expands more than untempered, and soft forged iron more than common commercial bars. The expansion varies slightly also with different qualities of the same metal, so that there can be no fixed formula by which to predetermine the exact amount of this change by temperature.

It may be stated generally that zinc will expand 0·0029, lead, 0·0028, tin, 0·0028, copper, 0·0019, silver, 0·0019, brass, 0·0019, gold, 0·0015, wrought iron, 0·0012, steel and cast iron, 0·0011, of its length by the addition of about 175° to its normal temperature. In other words, a rod of zinc 25 feet long will lengthen $\frac{7}{8}$ of an inch, lead and tin $\frac{13}{16}$ inch, copper, silver, and brass $\frac{5}{8}$ inch, gold and wrought iron $\frac{7}{16}$ inch, steel and cast iron $\frac{3}{8}$ inch.

It will be noticed that copper and brass vary much more than wrought iron: hence the unfitness of these metals for any part of an iron boiler, either for tube sheets or tubes. The expansion of steel being somewhat less than that of wrought iron, it would doubtless be good practice to use steel both for fire boxes and tubes in iron shells, on account of the more direct and intense heat in contact with these parts, which would compensate for the less expansive quality of steel.

One of the present long locomotive boilers, under the high pressure at which they are worked, will expand from five to seven sixteenths of an inch probably, depending somewhat upon the age of a boiler, and the quality and condition of the iron. Who can estimate the great strain thus imposed, and its effect upon the boiler and machinery when the side bars are rigidly fixed to the boiler? We only know that the boiler soon becomes leaky, and that the machinery does not retain that perfect linage in which it was first placed by the painstaking machinist, and which is so essential to the durability and economy of an engine.

It is true that most locomotive makers provide partially for the expansion of the boiler by elongating the screw holes in the feet of the brackets and braces that rest upon the side bars, and more recently by loops which embrace the side bars along the sides of the fire box; but there are some builders who still persist in fixing a central girder rigidly both to the boiler and side bars. I refer to the girder which sustains the rear end of the crosshead guides. I am partial to the looping principle, and this central girder and the feet of all braces attaching the side bars to boilers should simply embrace the side bars in the form of a loop nicely fitting the side bar; and the rear ends of the crosshead guides should slip into the central girder so as to allow of a slight lengthwise play.

But the saddle casting, to which the cylinders are attached, should of course be most rigidly and thoroughly fixed both to the boiler and side bars. Then the office of all the other fastenings which hold the side bars to the boiler would be simply to keep the guides and machinery in perfect line without obstructing in the least the free lengthwise play of the boiler. It is excellent practice to cast half of the saddle with each cylinder, and then bore and fit the cylinders together, so that they lay perfectly parallel with each other, of course both vertically and laterally, and then fit them to the boiler as a single casting. In getting up a pattern of this kind, the pattern maker should be familiar with some of the intricacies of molding; if he be not, he should consult an intelligent molder.

Worcester, Mass. F. G. WOODWARD.

MR. MERRICK BEMIS' address is New London, Conn., not New Haven, Conn., as stated on page 177, current volume.

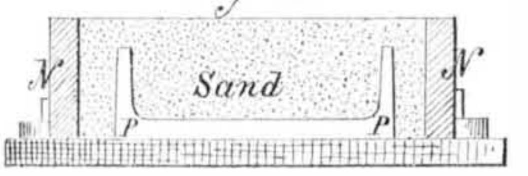
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XI.

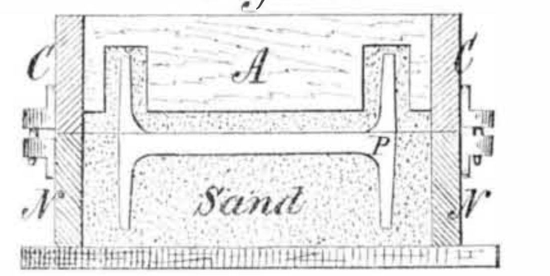
In Figs. 76 and 77, we have another example of flask molding, but for a pattern of different shape to our previous

Fig. 76.



one. The pattern is, in this case, not made in halves, its flanges on one side being left loose. In Fig. 76, one half of the pattern is shown on the molding board, and the nowel placed thereon and rammed with sand; while in Fig. 77 the

Fig. 77.

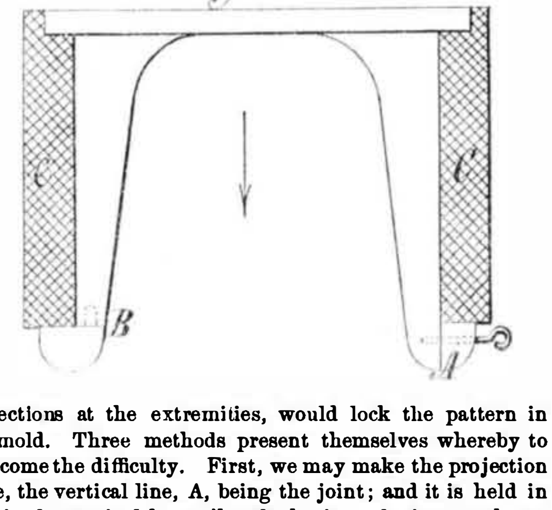


pattern is shown molded and ready to have the cope taken off, A representing one of the crossbars fitted into the cope and following the outline of the pattern.

CORES

are projecting bodies of sand, either left in the mold by the pattern itself or else made in a separate device called a core box. They are placed, after being dried, in position in the mold. The purpose of a core of the latter description is to leave a hole or recess of such a peculiar shape or in such a position that it is impracticable to make the mold of the necessary conformation by the use of the pattern alone. The use of these cores also permits us to modify the shape of a pattern that would otherwise be difficult to mold. For example, Fig. 78 represents a plate of such length that it is necessary to mold it in the direction indicated by the arrow; as the pendants, which are long and narrow, with their

Fig. 78.



projections at the extremities, would lock the pattern in the mold. Three methods present themselves whereby to overcome the difficulty. First, we may make the projection loose, the vertical line, A, being the joint; and it is held in position by vertical dovetails or by horizontal wires, as shown in Fig. 78. In the latter case, the molder, when ramming the sand, withdraws the wires; and when the pattern is withdrawn from the mold, the two different projecting pieces are left in the mold, and are subsequently retracted horizontally, and then lifted out. It is obvious that this can only be done when there is sufficient space to accommodate the projecting piece as it is withdrawn from its recess in the sand, and to admit of its being raised to the surface. To this method there is the objection that the recess left by the projecting piece in the mold cannot be, in many cases, either inspected or dressed if any reparation is required. A second plan would be to make the projecting piece join the pattern at the horizontal line, B, in Fig. 78, but separable from it; but in this case a three-part flask would have to be used, entailing double work for the molder. The third method is to affix the core prints, C C, to the sides of the pattern, leaving those sides smooth and even; and the pattern will then draw easily out of the mold. If we then core away all we have added to the pattern, as shown by the dotted lines in Fig. 78, the casting will retain the correct shape of the pattern. To effect this coring away, we make dry sand cores of the shape of the core prints, C C, and place them in the mold. Ordinary dry sand cores are composed of a mixture of sand and flour moistened with water, and they are molded to the requisite shape in the core boxes already mentioned. They are then baked, becoming sufficiently strong to handle; but previous to the baking they are so weak that they cannot be handled without being in some way supported. It is, therefore, as great a consideration to the pattern maker how the core is to be taken from the box as it is how a pattern shall be drawn from the mold. We may divide cores molded in a core box into three classes: First, those that lie as they are made; second, those that require turning over; and third, those that not only require