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CANADIAN MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 4. FEBRUARY, 1876. No. 2.

HOME INDUSTRY.

(Continued.)

THE WAYS AND MEANS.

In our January number we brought the subject before our readers, how HOME INDUSTRY might be made the *source of income in hard times.* We shall now endeavour to point out the WAYS and MEANS by which a small income can thus be realized. These WAYS and MEANS are not few, they are in fact numerous, and yet so many of them are totally unknown to mechanics, that hundreds of skilled workmen, when thrown out of employment, are unable to direct their thoughts to any way by which, through their own trade, they might earn, for a time, a living for their families. Too frequently they sit down depressed and gloomily brood over their difficulties, totally unable to think of any method by which they could, with the help of their mechanical knowledge and handicraft, set to work and manufacture articles from the sale of which they might support themselves in comfort until better times arrived.

We do not mean it to be understood that we suppose any article manufactured under such circumstances would meet with a ready sale, many probably would, if sold at moderate prices, but advances could be obtained on articles manufactured, and the goods placed in the hands of various parties, having shops or stores, who would sell them on commission, or, what would be better still, in a large city, to organize a society which should advance the means, if needed, to purchase such materials as would be required to be worked up, and when these articles were made to dispose of them to the best advantage for the makers' benefit—this is a suggestion which might very easily be carried out, and we feel confident it would be productive of much good. It would not only be the means of helping the mechanic in time of trouble, but it would be an instrument in educating the members of his family to industrious and profitable pursuits.

A society of this sort might be extended to other members of the community besides mechanics, but as it is the latter we have particularly to consider in this Magazine, we merely at present, throw out the hint, feeling how much better it is for society that none of its members should be dependent upon the charity of others for a subsistence, when they have health and skilled hands to procure it in an independant way, if only shown the *ways* and *means* by which so desirable an object can be brought about. And here let us remark that we have hundreds of wealthy manufacturers in this city, who in a very short time could organize a society of this kind and set the machinery in motion and that too with a trifling amount of capital. We may further suggest that if the clergymen of this city, (who are ever active to solicit contributions for charitable and praiseworthy objects), were to direct their attention, also, to this matter, and form a society of ladies for the promotion of *Home Industry* amongst those of that sex, we believe that, if properly managed, it would turn out a source of pleasure to those connected therewith, and a boon to many a well deserving family.

We have stated that there are many articles which skilled workmen could make at home in hard times, but there are many things which, to construct them, require the use of the tools and machinery of the work-shop; now we feel certain that where there is a proper spirit evinced by a body of industrious and worthy men, to employ their unengaged time to advantage, many manufacturers would not object to keep their workshops open, and their men around them, rather than see them dispersed and reduced in circumstances; in fact many of them would find it very convenient to have the workshop open and the men there, so as to be able to employ them occasionally as small orders required to be executed.

The WAYS in which a man with skilful hands can employ his unengaged time to advantage are various and numerous, but it is not necessary here to enumerate them, those details would form a matter for the consideration of a committee of practical men to decide upon, and if some active members of the community will take the first steps to organize a society for such a laudable purpose, then we will be prepared to place before them the WAYS by which it could be made to work successfully, if they will provide the MEANS, for we are resolved to make the CANADIAN MECHANICS' MAGAZINE—what it should be—the INSTRUCTOR and BENEFACTOR of the mechanics of the Dominion.

"INDIA." *

(See page 36 and 37.)

WE have already mentioned the beauty of the Book on INDIA, by M. Rousselet, revised and issued in England, and which appears at a moment when the people of this country are feeling more interest than usual in the East. It has a value, however, far beyond what a passing incident may give to it. The author has presented to the reader, as the preface correctly states, the result of a six years' study of the architectural monuments, religious beliefs and symbols dating back to earliest history, works of art, systems of civilisation, and progress, in an easy style calculated to fix the attention of the lightest as well of the more serious reader. The circumstance of the traveller having but very slight national connexion with the country explored, is of itself an advantage, as he brings a fresh mind and independent ideas to bear upon the subject, free from any preconceived bias or prejudice. He describes his impressions exactly as he experienced them, and we cannot wonder that his prevailing sentiment was enthusiastic admiration of what he saw. "The title of the work indicates the chief object of the author. He was comparatively indifferent to the India of railways, hotels, and telegraphs. He was bent on visiting the courts and countries ruled by native princes, great and small, of all ranks and all creeds, and to see for himself what are the modes of life and conditions of civilisation among the stately chieftains of native India. With this view he visited the kingdoms of the principal Mahrattah and Mahommedan sovereigns,—Scindia, Holkar, the Guicowar, the late Queen of Bhopal, and of the Nizam, and has graphically recorded his experiences, while some of his most vivid descriptions are devoted to the romantic history and achievements of the ancestors of the Rajahs of Central India." He makes his reader acquainted with the heroic traditions as well as the daily lives of the representatives of those ancient Rajpoot houses at the present day.

Various and many have been the efforts of European travellers and artists to create, in Europe, an appreciation of those works, at once mighty and beautiful, "designed by Titans and wrought by jewellers," which the Moguls bequeathed, after their long, though unhappy reign, over the principal parts of India. The Prince of Wales will not, it is true, see these alone; he has visited, amid a fictitious firework blazonry, utterly unbecoming to the thought and spirit of the scene, the Caves of Elephanta, and those solemn temples of the South, wherein, if Art ever expressed Religion, it was deified, however grotesquely. But the monuments most open to his view must be the trophies of the Mohammedan architects in the north-west, along the banks of the Ganges, and in the great interior, made splendid by "the magnificent son of Akbar." There is too common tendency in Europe to represent India as a country of gauze and gold; of palanquins and bearers; of equipage, jewelry, and glitter. But the Arabian conquerors, ruthless though they were, planted monuments in that soil, which are perfect beyond the power of imitation; and their works are not less imperishable in the history of art than are those of the Abencerrages in Spain. It is not for us, of course, to adopt this style; we can be no more Saracenic in architecture than we can be Saracenic in manners; but the comprehension of either signifies not a little; and it is utterly Corinthian, and Ionian types, as the only possible forms of strength and beauty. The new lesson is to be learned in India. No doubt, it ought to have been taught long ago, though the teaching might have been of slender use, except to the purely intellectual mind of the West. Climate governs architecture all over the world, whether the edifice be a Tartar tent or a Budhist temple; and yet, while we cannot hope or wish, for instructions from the dim Indian south, or the more joyous and splendid north-west, already made familiar in the photographic gallery at Kensington, we may look to a more special interest in them, after they have been illustrated by a visit from the Prince of Wales. Concerning few buildings on this earth has so much been heard as of the tomb which contains the dust and ashes of Shah Jehan and his wife. Colonel Sleeman confesses that, for five-and-twenty years of his life, he had looked forward to a glimpse of that unequalled mausoleum. When seen, it surpassed his every expectation; it went, indeed, beyond his fancy,—from the gateway to the dome, from the dome to the minaret, all appeared perfect to his eye; the Taj Mahal, indeed, satisfied the mind of a critical man who had been longing, through a period of twenty-five years, to see it, "from the first *coup-d'œil* of the dome in the distance, to the minute inspection of the last flower upon the screen round the tomb." It was what, in his memory, he said, he should never cease to see, and yet what he could never describe. That sculptured vault; those inscribed slabs of marble; the mosaic flowers embroidering the walls; that tomb, costing three millions sterling and more; what must have been its effect upon the Asiatic imagination? Colonel Sleeman asked his wife this question, and she answered,—"I cannot tell you what I think; but I can tell you what I feel: I would die to-morrow to have such another over me!" The edifice, though foreign ideas are blended in it, is a perfect example of Mogul architecture. It stands on the north side of a large quadrangle, looking down into the clear blue stream of the river Junna, while the other three sides are enclosed within a lofty wall of red sandstone. The entrance is through a magnificent gateway, between two beautiful mosques, corresponding exactly with each other in design, proportion, and execution. The vacant area is laid out in square parterres, planted with flowers, shrubs, and cypress; the pathways are paved with slabs of freestone; the gardens cooled by intermittent fountains.

We are enabled, by the courtesy of Messrs. Chapman & Hall, to reproduce the view of the gateway given in Mr. Rousselet's book.

But the mausoleum itself is the pride of the whole place, with the terrace upon which it stands, the minarets of white marble, inlaid with precious stones, the cupolas and columns around, and the pavements polished to the smoothness of ivory. We must not, however, concede the credit of these wonderful works entirely to the artists of the East. The Prince of England will meet more of the genius of Europe than that of Asia in these Oriental cities. The superb structures which make of Agra and Delhi shrines for the artist are due to the genius of a Frenchman, Austin de Bordeaux, who built the Mausoleum and Palace of Delhi, the Mausoleum and Palace at Agra, and was modelling the silver ceilings for both when a jealous contractor poisoned him. They could not, however, take away from his fame the incomparable fret works of the Pearl Mosque, erected at the cost of Shah Jehan; possibly the most exquisite structure in the Indian region. It is built entirely of white marble, without a bit of mosaic upon pillar or panel, richly flowered in relief, yet pure, simple, and majestic throughout. The sumptuously-coloured tomb of Akbar, in red, blue, and green, though more splendid in its reflection of that kaleidoscopic climate, is far less imposing exteriorly, though the interior is as one vast gem, and on which, unhappily, successive generations seem bent upon desecrating and destroying. It is thus with the tomb of Akbar himself, at Secundre, reared over his remains by his son the Emperor Jehangeer. His body lies deposited in a deep vault under the centre, and is covered by a plain slab of marble, without fretwork or mosaic. On the top of the building, which is three or four stories high, is another marble slab, corresponding with the one in the vault below. This is beautifully carved, with the ninety-nine names, or attributes, of the Deity, from the Koran; but, within, there is no mortal splendour that can be compared with it. One truth, however, always occurs to the European mind. The Mogul emperors, when they took up a residence at any particular place, always covered the neighbouring hills with luxurious and handsome buildings. Thus, at Secree, which the Prince will visit, is the mausoleum of a famous saint, the very porchway of which would eclipse in grandeur any similar structure or a thousand similar structures, in Christendom. The quadrangle containing the mosque on the west side, and the grave of the old hermit in the centre, was completed in the year 1578, six years before his death, and is, perhaps, one of the finest in the world. It is 575 ft. square, and surrounded by cloisters of imposing height and space. The gate-entrance surmounts a flight of steps 24 ft. high, and is itself of five times that altitude, being the same in breadth and pressenting beyond the wall five sides of an octagon, of which the front face is 80 ft. wide. In presence of this grandeur, can we have patience with those utilitarian Anglo-Indians who complain that these noble arches are worthless, because they can be made available neither by elephants nor by bullocks? "In all these cases," says one of the discontented, "the staircases are as disproportionaly small; they look as if they were made for rats to crawl through, while the gateways seem as though they were made for ships to sail under."

But what strikes a European most in going over the palaces and monuments of the Mogul Emperors is the deficiency of what a gentleman of fortune, in his own country, would consider as merely comfortable accommodation. "Five hundred pounds a year," writes a somewhat cynical Anglo-Indian, "would, at the present day, secure him more of this, in any civilised country of Europe or America, than the greatest of those Em-

* "India and its Native Princes. Travels in Central India, and in the Presidencies of Bombay and Bengal." By Louis Rousselet. Carefully Revised and Edited by Lieut.-Col. Buckle. Containing 317 Illustrations and six Maps. London: Chapman & Hall, 193, Piccadilly. 1875.

perors could command." Still, they have left their monuments, and the present and future centuries, which will never produce the equals of them, are bound to be grateful. They have a noble quadrangular garden at Deeg, one of the Prince's halting-places, encircled by an ornamental parapet. In the centre of each of the four faces is an exquisite pavillion, built of a peculiar sandstone, brought from a distance of about fifty miles. The flags, representing the natural strata, are about 16 ft. long, 3 ft. wide, and 1 ft. thick, and, without any use of the chisel, smooth as glass. With such materials at hand, a beautiful pavement shone beneath the feet of the wayfarer. And yet the modern aspect of these cities, brilliant though their monuments are, is saddening. Delhi is a ruin, Agra only the *succursale* of its renowned Taj, Benares a beautiful fragment, and they are preserved as wonders of the world, by the works of the Moguls alone. Thus, old Delhi is still a place of art pilgrimage, on account of the stately Khootub Meener, and its Palace of Deewan Khan, built without cement, the former, however, being the one cynosure of its kind in the peninsula. Strangely enough, there is no other tower in this Indian Empire of ours. Large pillars have been cut out of single stones to commemorate the conquests of Hindu princes, whose names no one was able to discover for several centuries; but they are rather evidences of mechanical skill than of artistic genius; while the Meener, grand in outline, chaste in embellishment, exquisite in finish, suggests not a critical thought. It is not very lofty—only 242 ft. tapering from a circumference of 106 ft. It is circular, and fluted vertically into twenty-seven semicircular and angular divisions. There are four balconies, supported upon large stone brackets, and surrounded by battlements of richly-sculptured stone, the whole having been originally white, though reddened now by the action of the atmosphere upon a ferruginous material. Archæologists have attributed this structure to the Hindus; yet it abounds in inscriptions from the Koran, and we know that the Mohammedans, except in the exultation of their triumph over St. Sophia, rarely adopted the temples of a hostile religion. Besides, the inscriptions are all in bold relief, which disposes of the question peremptorily. All these edifices, however, are slowly, but surely subsiding into decay, and the pretence of restoration now exhibited is no more than a revival of the fitful fancies which were prevalent a few years ago. In what condition is the slab of Mouzzim, the son and successor of Aurungzebe, the greatest among the crowned descendants of Akbar? It is mutilated and covered with grass. The domes of the tomb of Altmush have fallen in, and heaped the interior with fractured masses of white marble. That of the celebrated Imaum Mushudee, Akbar's religious counsellor and friend, was converted into a dwelling-house by an English civilian, who removed the sacred slab to make room for his billard-table,—an insult to the people which they avenged by assassination. The traveller can pass nowhere through this land of monumental magnificence without being reminded of that pride and that imagination which have left so many illustrations of themselves in Spain. The Prince will see, of course, the extraordinary tomb of Nizamoodeen, which Bishop Heber compared to a pile of potted meat, so grotesquely varied are the tints of its architecture; but in addition to these grander memorials, there may be seen hundreds of lonely minarets, seemingly fragile, yet wearing the complexion of age, pretty white domes, better adapted, one thinks, to be pavillons of pleasure than the shelters of graves, and a thousand other substantial reminiscences of a power, a glory and a wealth long vanished from the land. It is the mausoleum of Humayun, with all its vastness and sumptuousness, that most truly tells the tale of the Mogul conquest and dominion. Not the mosque known as Jumna Musjid, the *chef-d'œuvre* of Shah Jehan, and the cheapest building of its class ever erected. It cost simply 100,000l. In England, supposing the materials equally cheap, it must have cost half a million. But the Emperor, if he economised with his mosque, made up for it in his palace, "the architectural garden," as it has been termed, though civilisation has whitewashed its pink colours, dilapidated its throne, shattered its lovely jewelled mosaics, for the sake of plunder, and left it a scene of picturesque desolation.

Mr. Rousselet illustrates and describes this remarkable structure, and we are enabled to give one of the smaller views of it. "After taking possession," he says, "of the room which was allotted to us by the rules as the rate of one rupee per day, I left the bungalow, and, accompanied by Schaumburg, proceeded towards the mosque, the sacred Jumna Musjid, one of the monuments which the Musulmens of Central Asia and of India most venerate and admire. This edifice, entirely composed of red sandstone, is raised upon an immense terrace, to the summit of which three magnificent pyramidal staircases lead, each terminating in a monumental doorway. We then found ourselves in a fine marble-paved court, surrounded with cloisters of singular lightness and elegance, and ornamented in the centre with a fountain of a winding shape, designed for the ablutions of the faithful. At the end of this court, the broad face of the mosque extends. It is composed of a long row of low narrow arches, on each side of a lofty doorway, in the form of a pointed-arched niche; and three white marble domes, with black mouldings, much too large in proportion to the moderate height of the facades, crown the edifice, which is flanked by two superb minarets, striped longitudinally with white and pink, and elevating a delicate cupola of white marble in the air to a great height. The whole effect is grand and imposing; and, notwithstanding some defects, we may agree with Ferguson that the great mosque of Delhi is the masterpiece of Indo-Mussulman religious architecture; but what no description can do justice to,—and even engraving itself is powerless to assist it,—is the incomparable effect produced by the vivid though severe colours which clothe every part of the building when they are illuminated by the glorious sun of India. The dark red of the galleries, the black and white marble of the facade, the whiteness of the domes crowned by glittering golden pinnacles, and the rose-coloured stripings of the minarets, stand out against the blue background of the sky without any crudeness, but rather with a severe harmony, proving the care with which the architect had combined and matched the varied shades, and skilfully calculated their effects, according to the different parts of the edifice they were connected with."

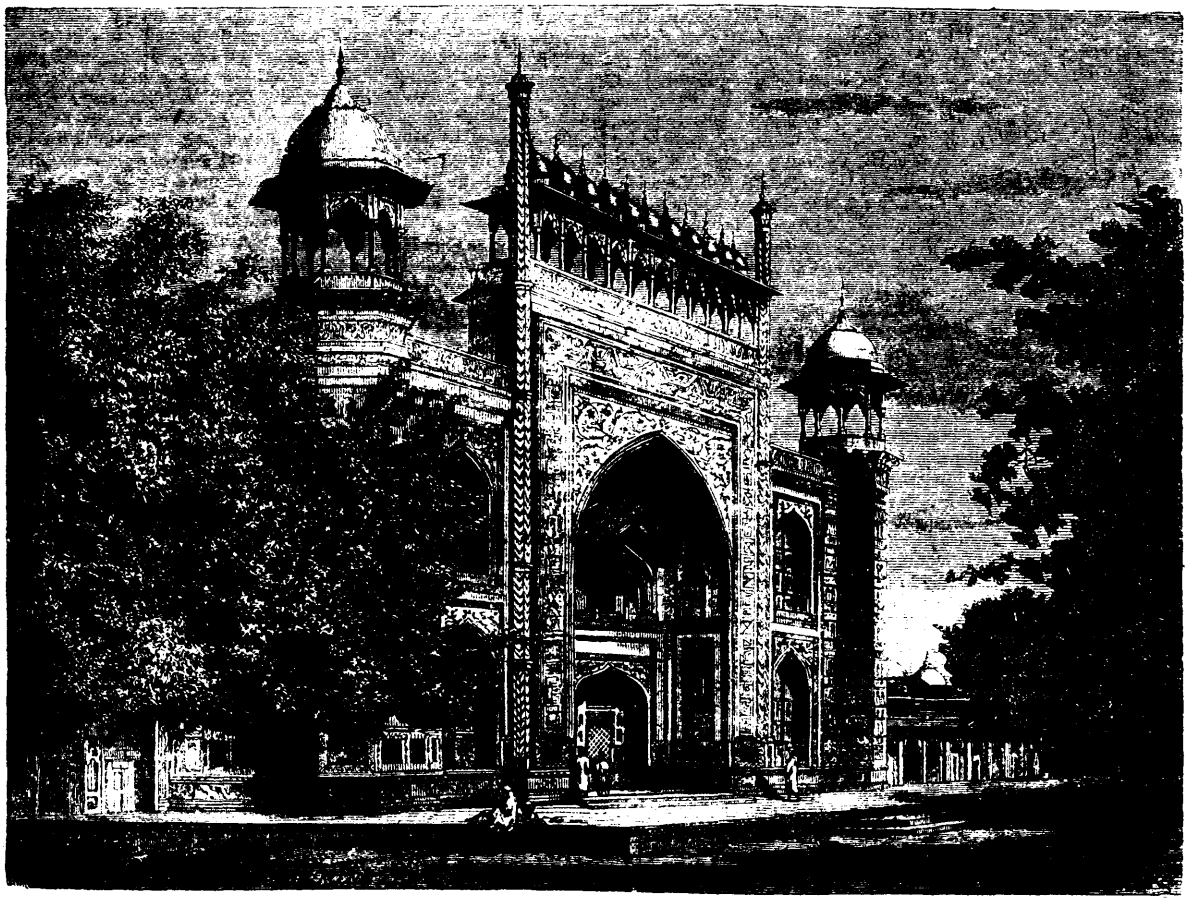
The interior of the mosque is very simple. Its roof, pillars and pavement, of white marble, are embroidered with delicate arabesques carved in the stone; and on the walls slabs of black marble bear short inscriptions in praise of God, and in memory of Shah Jehan, the founder of the mosque.

At the southern extremity of the Plain of Delhi,—an immense field of ruins,—stands the remarkable triumphal column, or, rather, tower, known as the Kootub. We give a view of the fine gateway in the inclosure. "Alladeen's Gate" (as it is called,) "erected by the Sultan Ala-ood-deen, might have inspired the celebrated author of the Wonderful Lamp; the genie of the Roc could have created nothing more fairy-like. The work of the Moors of Spain in the Alhambra of Granada is not to be compared to this perfect gem of architecture. Here it is the stone itself, a red sandstone relieved by stripes of white marble, which gives the colouring; and the delicate arabesques which cover it on all its sides are carved and inlaid; while at Granada the whole effect is obtained by a combination of bright colours and gildings, simply spread on ordinary brickwork. Moreover, there is no part of the Moorish Alhambra in which we can find the same purity of outline and grandeur of proportions that characterise in so high a degree the Gate of Alladeen." It forms a sort of square pavillon, perforated on each of its four sides by an indentated arch, and surmounted by a beautiful cupola; and the inner hall is as richly decorated as the facades. Having passed through this gate, visitors find themselves almost suddenly at the foot of the Kootub, which stands alone and isolated in the centre of a paved court, proudly raising its head at a height of 227 English feet.

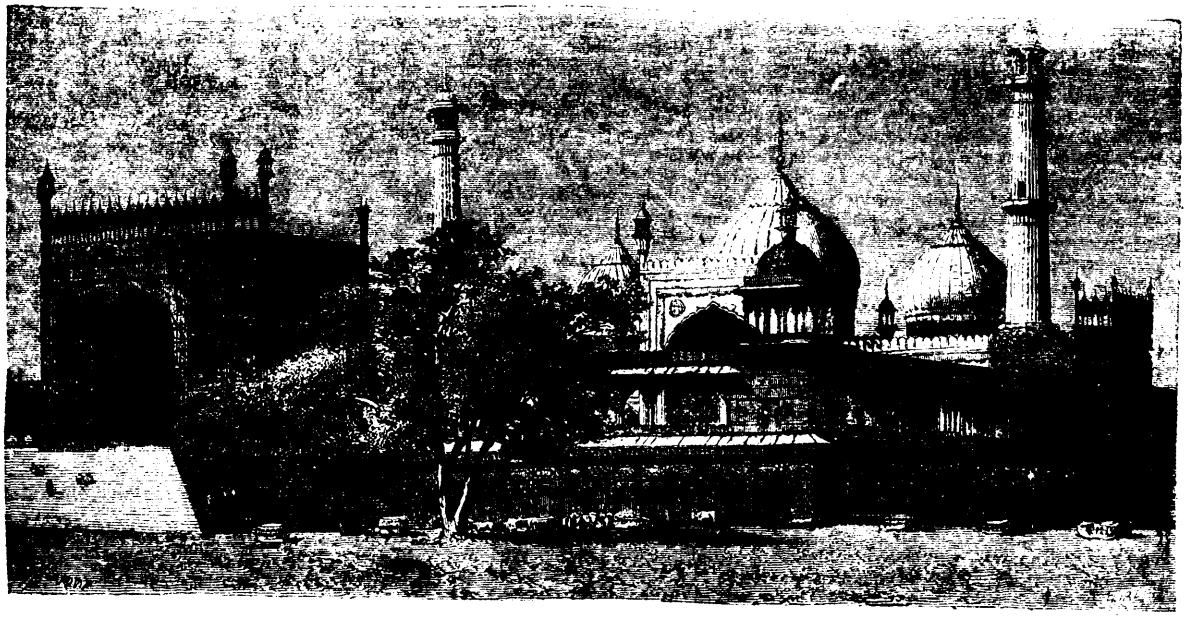
The contrast between these gaudy exotics of Indian art, and the massive, solemn, almost sepulchral grandeur of such shrines, for examples, as those of Viayanagar, representing an enormous opulence and power;—terraces a thousand yards in length, of Babylonian solidity; gates surmounted by ponderous pyramids; idols rivalling in magnitude those of antique Egypt; staircases broad as a public street; temples crowded in hundreds, and each sufficiently superb to satisfy a modern town; infinite richness of sculpture; but no colouring whatever, no polychromatic fancies, for those blocks of granite, 20 ft. by 12 ft., grey as they were at the creation and worn as though by whole cycles of slow, unviolent change. The two great epochs of Indian history stand forth here in a contrast and identification the most absolute conceivable unless we give the palm to the Pagodas of Chillambaram, those seven sisters—or Lamps, if we prefer it—of a remote and mysterious art which carry in each of them the meaning of an entire mythology, dark, melancholy, and mysterious, but not exclusively black. They are varied by porphyry statues, and columns of sandal wood, by constantly renewed dedications of flowers, and by blazonries of polished copper, but never by a gem, a dash of vermillion, or so much as a square inch of mosaic. Why they were erected, human knowledge has never yet been able to say; but that they are the trophies of war, like the monuments of the Moguls, no student of the Indian chronicles will believe. Those men, to all appearance, reared their temples as expiations; the Moguls reared theirs as triumphs.

We will end as we began, by recommending to our readers "India and its Native Princes."—*London Builder.*

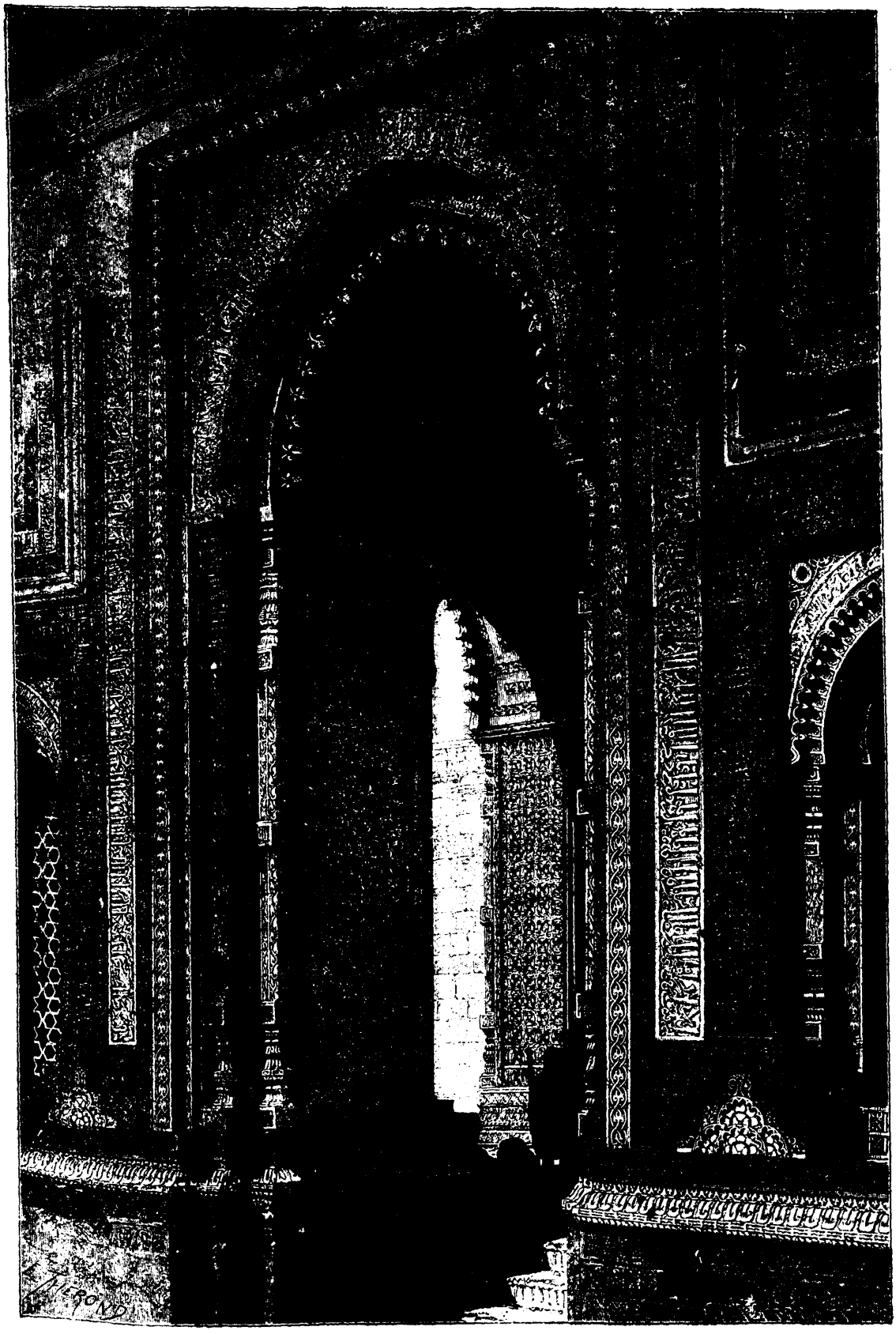
INDIA.



PRINCIPAL ENTRANCE OF THE TAJ GARDENS, AT AGRA.



THE JUMNA MUSJID.



ALLADEEN'S GATE.

ANCIENT ENGINEERING, ITS METHOD AND APPLIANCES.

No. I.

The word architecture in our day is principally applied to those constructions in which ornamental art is super-added to utility; but in remote times much of what we now call engineering, even including the construction of various machines, was expressed in that word. Thus Vitruvius' work, "De Architectura," contains chapters on machines for raising and transporting great weights, and even on the construction of looms, and that author himself held the post at Rome of inspector of war machines. Indeed, up to the middle of the fifteenth century, architecture and engineering mingle at many points, and the civil engineer of the future will be better educated, and have to pay more attention to the æsthetic element in his art, than has been often exemplified in the past. The history of architecture, viewed in its technical side—or as the builder's art—has, until within a comparatively recent period, almost no history, except that which has been derived from the observation of its monuments. These, while they have sufficed to hand down to our admiration and imitation the forms of beauty which were slowly elaborated by the ancient masters of the art, afford but little information as to the methods and contrivances employed in their construction; and in most instances even less information as to the technical methods employed by early architects or engineers has been obtained from the observations made in modern times of their monumental works, because architects and archæologists, who have been the chief observers and recorders of these works, have been themselves very generally more bent upon the æsthetic than the constructive element, of the latter of which they were very commonly ignorant, and hence have not known how and where to look for such indications in the buildings they have examined and measured as might, if carefully reasoned upon, have afforded more or less information upon technical methods and appliances by which they were erected, and as to which nothing else now remains for our instruction. In many instances, indeed, nothing is presented by the monuments of ancient art, however carefully examined, to give us any clue to the methods employed in their construction. We may create in imagination, with more or less of probability, the apparatus and methods by which the huge blocks of stone of the Egyptian Pyramids were raised and put in place; but the imagination receives little aid in such creation from anything now presented by the Pyramids themselves. On the other hand, the architect or engineer, well versed in the technical conditions of their art, can readily discover for himself the reason of the curious fact that the joints of the masonry of the Pyramids were laid in mortar, whereas many of the great monolithic structures of the same epoch were laid dry, or without mortar, as were also the enormous blocks of stone which, centuries after, were bedded into the walls of Pelasgic or Etruscan cities. Architecture, though transcending in antiquity the history or even traditions of the human race, of which the use of mortar 5000 years ago, as above cited, is an illustration, has in fact little or no written technical history that goes back more than three or four hundred years. Thus we know much historically about the Parthenon, and even the names of the sculptors employed upon its ornaments have reached us, but we know almost nothing as to the technical methods employed in the chiseling and putting in place of its fluted columns and their entablatures, and it is even matter of vague speculation whether the steps of the peristyle were laid perfectly level, or whether, for some mysterious reason, the surfaces were slightly curved, and lowest at the corners of the edifice, as they now are said to be. We know next to nothing as to what was the social status of the architects who designed and constructed the vast edifices, domes, aqueducts, and bridges of imperial Rome in its wealthiest days, and almost nothing of the same class of men who completed like works in distant parts of the empire; and of the constructive methods which they employed, we know scarcely anything beyond what may be gathered or inferred from a skilful examination of their works which still remain.

The introduction of arched structures gave rise to the most complicated forms of stone cutting, as seen in the amphitheatres which remain, where every complex form of archwork—skewed, conical, or twisted, as well as the close-fitting joints of the spectators' seats, the stairways, and the accurate elliptic lines of the plan—all prove how precise must have been the instruments and methods by which the designs of the master builder were carried into effect by the stonecutter or mason. But we know nothing as to what these methods were, what was the nature of their moulds or templates, by what means were the everchanging angles required in the separate blocks of stone transferred from the designs for the guidance of the stone-cutter: we do not even know with any certainty upon what sort of material, whether parchment, papyrus, wood panels, or waxen tablets, the designs themselves were drawn. At a still later period, after pointed architecture and cathedral building had evolved themselves all over Europe, still more complex forms of stone cutting became necessary, and the stonecutter's art reached a perfection in the complicated groins and vaulting of such buildings, which has never been exceeded. Yet even here, when we approach nearer to architectural written history, our information is of the most imperfect character as to what were the constructive methods employed. In this dearth of information, therefore, there is the greater reason for noting well any structural peculiarities in ancient architectural monuments which may enable us by a process of reasoning to infer from the work itself more or less as to the methods employed in its design and construction, and ultimately from these to infer more or less what was the extent of scientific knowledge and practical skill of the designers. In the following articles it is proposed to point out two examples of ancient structural methods as thus inferentially derived from examination of the structures themselves, both being instances of great technical interest, and which appear hitherto to have escaped the notice of engineering and architectural authors. The first of the examples about to be dwelt upon is that of the Pont du Gard, in France; the second that of the so-called Mole of Caligula, in the Bay of Pozzuoli, near Naples.

(To be continued.)

THE CIRCULAR RIP-SAW.

Prominent amongst the vast array of tools which inventive genius has placed in our furniture factories is the circular rip saw; it is, at the same time the most efficient, and the most delicate tool in use, and the success of its operation depends entirely upon the skill of the workman who handles it; ordinarily, it is placed in the hands of men practically unable, and totally unfit, to have charge of it. The trade of a sawyer is only acquired by years of experience, but not more than five per cent. of the professed sawyers in the land approach any high degree of perfection; the majority of them work hard and accomplish little. Wherein is the fault? Is it the man or the tool? oftener it is the tool; provided with a geometrically-true table constructed upon scientific principles and a perfect saw, other things being equal, the labour of running a saw ceases to be a source of physical and mental discomfort, and the sawyer views his work at eventide with evident satisfaction.

In this connection I will note down a few points of practical interest to the sawyer. In the first place it is indispensable that the frame should be heavy and well constructed; the table should be hinged at the tail end to allow it to be adjusted for thick or thin stuff, *ad libitum*. This may be accomplished by means of a rack and pinion, or a screw at the head end. Care must be exercised to prevent any lateral motion of the top; this in itself is a very important matter and should receive daily attention; the top should be very rigid, especially in front of and close to the saw to prevent any spring down of table or stock; the fence should be the full length of the table, easily adjustable, geometrically true, and in perfect line with the slide-board and saw. The mandrels should be of steel, not less than 1 1-2in. diameter; should be turned perfectly true of a standard gauge from end to end, and devoid of collars, in lieu of which 3 or 4 V-shaped grooves should be turned in the journal remotest from the saw. Just here let me state in parenthesis that the average mandrel is a magnificent mistake, excelled only by Allen, Thurman, and Co.'s "rag baby" finance plank; better have a mandrel made to order and pay two prices for it.

The mandrel should be turned on *drilled centres*, and the best lathe hand invariably employed on the job; the pulley should be straight on the face, and emery-dressed, to make it perfectly smooth, and always placed between journals. The flanges should be of the same diameter as the pulley, and free from all sand-holes and other imperfections, the faces should be turned straight 3-16ths of an inch deep, and from that point recessed or rebated to the centre, for scientific reasons. By no means whatever introduce a pin to prevent the saw from turning between the flanges; it is not only a detriment to the saw, but any applied force sufficient to stop the saw would cut the pin off; rather use a left hand nut on the end of your mandrel.

The saw should *fit the mandrel*, not hang on it, neither should it be driven on with a sledge. It, as well as the flanges, should be kept scrupulously clean and should not be allowed to become defaced or battered; the saw should be filed as often as it becomes

dull. There are two settled methods of setting a saw—to wit, one (the best) is by means of the swage or upset and a hammer; when this method is adopted side-setting must be wholly ignored, as the two combined are a failure; the other (side-setting) to do perfectly, requires nice manipulation and fine discriminating mechanical judgment; where this method is adopted it would be well to observe that the *points* only and *not* the whole teeth should be bent; by observing the above you will avoid friction, which is, to say the least, desirable.

Filing is an art, the consummation of which is only reached by *practical experience;* the requisites are, a steady hand, good files, parallel jaws, and an understanding and perfect knowledge of what you are about to undertake. Amongst the most dexterous manipulators of the file is the locksmith, yet one of these experts without instructions would, in a very short time, render a saw unfit for use. To all sawyers I will say, in the words of Davy Crockett, "be sure you're right, then go ahead."

In the first place we will consider what is of the most importance—the correct pitch of the teeth. For this there is a set rule unknown to many sawyers, and which I will endeavour to elucidate. Fit a circular piece of wood or leather in the eye of your saw; now from the centre to one-half the distance from the centre to the circumference (the points of the teeth) describe a circle; then, with a straight-edge, draw lines inclining backwards from the point of each tooth, tangent to the circle. This will give the correct pitch to the front of the tooth, and will work equally well in hard or soft wood. The depth of the throat will depend upon the size of the tooth and should always be deep enough to hold the sawdust each tooth will cut; the area of the throat should never be less than the area of the tooth. The teeth both front and back should be filed square with the face of the saw; the fronts should be perfectly straight from the point to the bottom of the throat; were it possible to file the front concave a better cutting edge would be obtained, but as this would necessitate a convex file, and nothing perfect of the kind having been invented, we must forego the desire for so working the teeth. The backs of the teeth should be filed "straight away" from point to heel; some sawyers claim that the back should be reached to strengthen the teeth. Now, this places the strength just where it is not wanted, and renders the acquisition of a perfect cutting edge impossible. The points should be *square,* and exactly resemble so many small firmer chisels.

One other item and I will be done. The saw should but just come through the stock, not only to lessen friction, but also to allow it to cut more nearly with the grain; for this reason, the hinged table and a moderately large saw is suggested. A practical experiment will demonstrate the truth of my statement.

An important item is a properly balanced mandrel; too much attention cannot be given to this fact. Speed is another requisite; as a general thing, ignore the speeding saws furnished gratuitously by saw-makers. You can run a 16in. saw, No. 16 gauge, 3,500 revolutions a minute, with impunity; or, to adopt a more perfect guide, let the circumference of your saw, large or small, pass through 15,000ft. of space per minute; finally, your belting must be good, soft and pliable, worked with the hair side to the pulley, and devoid of metal rivits. Good lap joints, well cemented and properly secured by means of common shoe-pegs, are the best, and approach nearer to everlasting than any other now in use. Hoping this may meet the eyes of many, I give it as a few recollections of the long experience of a professional sawyer.—*English Mechanic.*

DISCOLOURATION OF PAINT.

Most of our readers are familiar with the fact that light-coloured paints, especially those having white lead as a basis, rapidly discolour under different circumstances. Thus white paint discolours when excluded from the light; stone colours lose their tone when exposed to sulphuretted hydrogen, even when that is only present in very small quantity in the air; greens fade or darken, and vermilion loses its brilliancy rapidly in a smoky atmosphere like that of London. Herr Ludersdof, of Berlin, thinks that the principal cause of the destructive change is due to a property in linseed oil which cannot be destroyed. The utility of drying oils for mixing pigments depends entirely on the fact that they are converted by the absorption of oxygen into a kind of resin which retains the colouring pigment in its semblance; but, during this oxidisation of the oil—the drying of the paint—a process is set up which, especially in the absence of light and air, soon gives the whitest paint a yellow tinge. Herr Ludersdoff therefore proposes to employ an already formed but colourless resin as the binding material of the paint, and he selects two resins as being specially suitable—one, sandarac, soluble in alcohol; the other, dammar, soluble in turpentine. The sandarac must be carefully picked over, and 7 oz. added to 2 oz. of Venice turpentine, and 24 oz. of alcohol of specific gravity 0·833. The mixture is put in a suitable vessel over a slow fire or spirit lamp, and heated, stirring diligently, until it is almost but not quite boiling. If the mixture be kept at this temperature, with frequent stirring, for an hour, the resin will be all dissolved, and the varnish is ready for use as soon as it is cool. The Venice turpentine is necessary to prevent too rapid drying, and more dilute alcohol cannot be employed, because sandarac does not dissolve easily in weaker alcohol, and, furthermore, the alcohol, by evaporation, would soon become so weak that the resin would be precipitated as a powder. When this is to be mixed with white lead, the latter must first be finely ground in water and dried again. It is then rubbed with a little turpentine on a slab, no more turpentine being taken than is absolutely necessary to enable it to be worked with the muller. One pound of the white lead is then mixed with exactly half a pound of varnish and stirred up for use. It must be applied rapidly, because it dries so quickly. If when dry the colour is wanting in lustre, it indicates the use of too much varnish. In such cases the article painted should be rubbed, when perfectly dry, with a woollen cloth to give it a gloss.

The dammar varnish is made by heating 8 oz. of dammar in 16oz. of oil of turpentine at 165° to 190° Fah., stirring diligently and keeping it at or about this temperature until all is dissolved, which requires about an hour. The varnish is then decanted from any impurities and preserved for use. The second coat of the pure varnish, to which half its weight of oil of turpentine has been added, may be applied. It is still better to apply a coat of sandarac varnish made with alcohol, because dammar varnish alone does not possess the hardness of sandarac, and, when the article covered with it is handled much, does not last so long.—*English Mechanic.*

GIRARD AVENUE BRIDGE.

(See pages 40, 44 and 45.)

This bridge spans the Schuylkill river in the city of Philadelphia, at the main avenue of approach to Fairmount Park and the Exhibition buildings, and is one of the great public works that will interest visitors to the Centennial Exhibition. It is remarkable as the first attempt in the United States to combine the American system of pinjointed, openwork girders, distinguished for their lightness of appearance, with a solid roadway of stone, constructed in that massive and substantial manner which is customary in England and on the Continent. To this is added a higher degree of architectural ornament than is common. The height of the roadway above low water is 55 feet. The girders rest on three piers and two abutments, and form the centre spans of 197 ft. each and two side spans of 137 ft. each. The height of the lower chord above low water is 23 ft. The bridge has a camber of 18 in. in its total length.

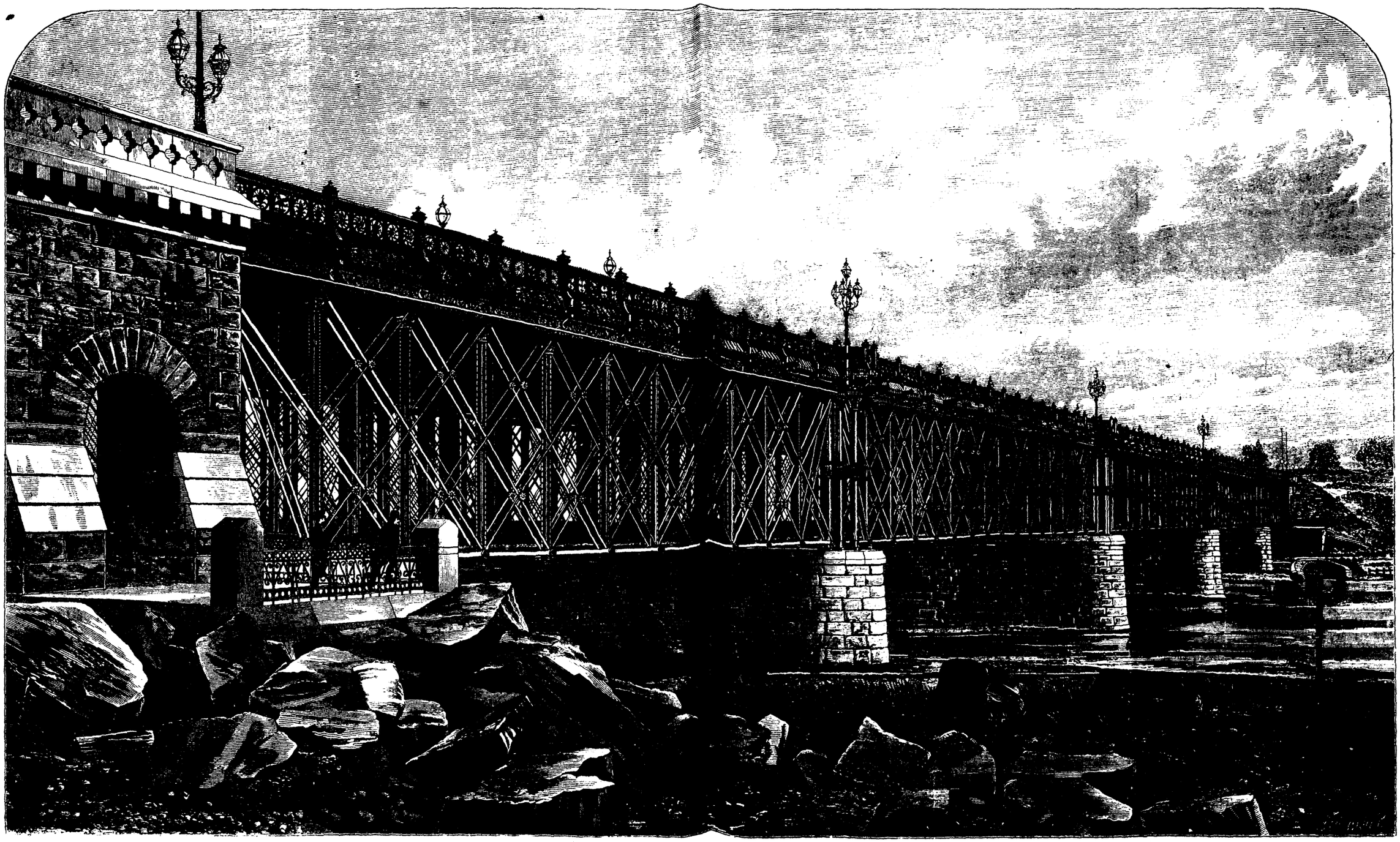
FOREIGN GLEANINGS.

TICKET CEMENT FOR TIN GOODS.—An effective cement for fastening paper tickets to tin goods is said to consist in a solution of gum to which ammonia has been added. Glue with which a small quantity of glycerine has been mixed is another good cement.

PARIS OMNIBUSES.—The following statistics respecting the traffic of the omnibuses have been published:—In 1855, the omnibuses carried forty million passengers; in 1860, seventy-two millions; in 1867, Exhibition year, 121 millions; in 1869, 119 millions; in 1871, seventy-eight millions; in 1872, 111 millions, and in 1874, over 115 millions.

UNBREAKABLE GLASS.—Mr. F. M. Stahl, the manager of the Berlin Meteorological Instrument Company, has succeeded in making glass cylinders hard enough to resist any change of temperature; they stand good even if plunged, after heating, into cold water. Another Berlin Company, that for domestic warming and ventilation, sells lamp cylinders of hard glass.

IMPORTATION OF MACHINERY INTO RUSSIA.—In 1863, the Russian imports of machinery were valued at 6,000,000 roubles; in 1873, 24,000,000 roubles; other metal goods in 1863, 5,000,000 roubles; in 1873, the Russian export of corn alone was 164,000,000 roubles, and flax, 41,000,000 roubles.



THE GIRARD AVENUE BRIDGE, PHILADELPHIA.
(Constructed by Messrs. CLARKE, REEVES & Co., Engineers.)

THE CASTALIA.

We learn from the report of the English Channel Steam Ship Company that the Castalia is a success. This statement must, however, be taken with certain limitations. The ship is so far popular, that during the few months she has been running she has attracted a great deal of the passenger traffic between England and France, having carried, we believe, about 6,000 passengers. Opinions have been very freely expressed concerned the ship ; and dozens of letters have appeared in our daily contemporaries, the writers, almost without exception, bearing testimony to the fact that she is the most comfortable boat that has ever plied between Dover and Calais. This is, perhaps, not saying much. It is more to the point that few are sea-sick on board her, even in very rough weather. On the whole, we are disposed to agree with her proprietors, that the Castalia has fairly settled what a Channel steamer should be. In this sense, then, Captain's Dicey's ship is a success ; but, unfortunately, she is not a commercial success. The continual alterations rendered necessary by the imperfect character of her machinery have cost a great deal of money. Her enforced idleness from the same cause during a long period, has swelled the bill, so that as she stands she must be regarded as a costly ship. Worst of all, she does not carry passengers enough to make her trips pay ; and we believe that at present her earnings do not cover her expenditure. The truth is that she has one primary, and it is to be feared irremediable, defect—she is desperately slow. So slow, that if she starts from Calais when the Paris trains comes in, she is certain to be late for the train on this side for London, and the passengers have to wait at Dover for another train. If only this defect could be overcome, however, it appears that the Castalia would enjoy more passenger traffic than she could accommodate. The ship is practically, although not absolutely, the first of her kind, and it was hardly to be expected that she could be perfect in every respect. But Captain Dicey has proved that passengers can be carried with comfort and certainty, although at a low speed, across that terrible 20 miles of sea which have hitherto been the terror of bad sailors. He has done enough to demonstrate that his ship is right in principle so far ; and it is to be hoped that the experiment will not be suffered to end at the present stage, but that efforts will be made to improve the speed of the Castalia and to put another and better boat of the same type upon the station. No improvement can be anticipated, however, unless great care is taken to utilise the lesson which experience with the Castalia has taught.

From the first it was seen that unusual difficulty would be experienced in propelling a twin-ship at a high speed through the water. Mr. Froude's researches have gone far to prove that almost the entire resistance offered to sharp ships producing few eddies is due to skin friction ; but the Castalia has a wetted surface equal in area to twice that of a single ship of her given tonnage. Her resistance, therefore, must be equal, as regards skin friction, to at least double that of a single ship. The Castalia, we may remind our readers, consists of two distinct hulls, each 290 ft. long by 17 ft. beam. The intervening space is 27 ft. wide, and the hulls are united above by a deck 183 ft. long and 60 ft. wide. The hulls are "wall-sided" on the inner sides ; on the outer they are moulded to easy curves. Between them is hung a pair of paddle-wheels about 22 ft. in diameter. These wheels are placed side by side, and driven by independent engines in each hull. The arrangement is altogether one calculated to cause the maximum of friction retardation ; for not only have the hulls to contend with what we may term the natural resistance of the water through which they are urged, but they have also to deal with the friction of a rapid current thrown astern by the paddle-wheels, the wave produced by these last having no means of lateral escape until it has traversed a distance of about 145 ft. Again, owing to the splay of her bows, water is, so to speak, collected and directed into the mid-ship channel from the front ; and when a sea is running the waves heap themselves up in front of the paddles from this cause that except in calm weather, a considerable number of floats are broken or injured on almost every trip. On one occasion indeed, we understand the ship reached Calais with only half her floats left. It is to be regretted that the owners of the ship have been so reticent on all matters concerning the machinery that it is impossible to obtain or supply that criticism which, coming from independent authorities, might have proved eminently useful to them. Enough is known, however, to enable us to point out certain defects which might, perhaps, be remedied in the case of the Castalia, and may certainly be avoided in that of a new twin ship. Mr. Aston has recently carried out a very curious series of experiments on the efficiency of paddle-wheels of various types. Into details we do not at present feel at liberty to enter ; it will suffice for our present purpose to state that Mr. Aston has proved that paddle-wheels should be kept as far as possible from the sides of a ship, and that the floats should be deep and narrow, instead of being shallow and wide. On the Thames is a floating steam fire engine propelled by paddle-wheels. This craft—which was illustrated—for years never attained a speed of much above seven and a-half miles an hour. Fitted with the Aston paddle-wheel she now makes ten miles, the revolutions of the engines remaining about the same. No complete theory of the action of paddle-wheels has ever been proposed ; and it is not easy to explain quite satisfactorily why an alteration in the shape of the paddle-boards and their removal by a few feet from the side of the ship should produce so remarkable an improvement in speed. Mr. Aston's own idea is, that when paddles are fitted in the ordinary way, the water is driven against the side of the ship, and that the skin friction is therefore enormously augmented. It is known we may add, that when a ship is in motion she carries a film of water with her, which film is slowly changed as she advances, and the true friction takes place, not between the sides of the hull and the surrounding water, but between the water at rest as regards the ship, and the film moving with her. It is not improbable that the action of the paddles interferes with this process, and that the water driven back breaks up and destroys the film. Be this as it may, the fact remains that when paddles work close to a ship's side they enormously increase her resistance. Now if we apply this line of argument to the case of the Dicey ship, it will be seen that she is worse off than any other class of vessel ; and if she is to be propelled by paddles at all, then they should be made very deep and narrow, and kept as near the centre of the ship as possible. We have reason to think that the Castalia would do much better with only one of her present wheels hung right in the centre of the mid channel, and with the boards a little increased in depth though not in width, than she does now ; and it would be worth while to try the experiment tentatively of cutting her paddles shorter and shorter, to ascertain the effect of the change on her rate of steaming. We cannot see how in a new Castalia, should one be built, it will be possible to render her wheels more efficient in any other way than that proposed by Mr. Aston for the paddle-wheels of all classes of boats. Whether the directors of the English Channel Steamship Campany are or are not aware of what Mr. Aston has done we are not in a position to say, but we think that it would not be unwise that they should give his invention careful consideration, aided, of course, by adequate professional advice.

It is a question, however, whether or not paddles are or ever can be under any circumstances, the best propelling instruments for such a craft as the Castalia. If she were fitted with screws she would probably do a great deal better. It is true that on her light draught of water she could not use a screw much over 8ft. in diameter, but she would of course have two, and there is reason to think that the advantages to be derived from the use of screws of large diameter are overrated. It may probably yet be found that small screws driven at a high velocity will give better results than large slow-moving screws. At least, this is somewhat like the conclusions to which Mr. Griffiths' experiments are apparently leading him. A twin ship might be fitted with four screws without trouble, and they would, we have no doubt, give much better results than paddles. One other point deserves the consideration of the directors. Before laying down the lines of a new Castalia they ought to carry out a careful series of experiments on a model of adequate dimensions, to determine the best form of hull, especially with regard to the entrance and run of the mid-channel. It is unfortunate that the ship must be double-ended in order that she may not have to turn round, because it is practically impossible to give lines of least resistance to any double-ended boat, and all the imperfections due to this cause are practically doubled in a twin ship.

It is not very easy to explain why people are not sick on board the Castalia, for in a sense she is lively enough. It would seem, however, that all her movements are of small amplitude, and that she supplies, therefore, as regards the internal human economy, a steady platform. There is a comparative absence, too, of that pitching and 'scending motion which is the most trying to weak stomachs. Again, it is to be remembered that very few people are sick all at once ; and if the trip is of short duration many persons escape altogether who would be very ill if the voyage lasted three hours instead of one or two. There is no room to doubt that the Castalia is extremely comfortable, and that the Channel may be crossed on board her without fear of sea sickness by ninety-nine persons out of a hundred. The production of a ship of which this may be said is a remarkable achievement in

naval architecture; and we trust that the English Channel Steamship Company will be able to continue the good work they have begun, and place next year at the service of the public a ship which will possess all the advantages and be free from the somewhat important defects of the Castalia.—*Engineer.*

POISONOUS DYES.

The *Pall Mall Gazette* calls attention to this subject in the following way: "Adulteration is bad, but poisoning is worse, especially poisoning by arsenic. The agonies which are endured by those who have swallowed or imbibed arsenic in poisonous quantities are too well known to need mention, and arsenic applied in the shape of dye for materials, whether silk or woollen, which are worn next the skin, brings about consequences nearly as dangerous and as painful. Attention should be called to the subject, because it seems that manufacturers are recommencing the use of this substance for dyeing articles of personal apparel. That arsenic (in the shape of Scheel's green) has long been used to produce the well-known dazzling green in dresses, artificial flowers, and papers for walls, and that these articles have produced all the effects of arsenical poisoning, are facts so well established that sensible people have contented themselves with avoiding any material of that particular color; but lately Dr. Sedgwick wrote to the *Times*, stating that his wife and himself having 'suffered much in the manner that people do when poisoned by arsenical vapors,' he analyzed his bedroom paper, which was pale blue, and found a large quantity of arsenic. Now blue wall-papers are generally thought safe. Some years ago silk socks and stockings dyed in stripes of very brilliant hues—orange, purple, and crimson—were sold; and many persons suffered frightfully through wearing them. The first symptoms were intense irritation in the skin of the feet, swelling, and an inflamed appearance; then an outbreak of watery blisters of all sizes, from group of the size of hempseed to single blisters on the sole of the foot larger than a five-shilling piece. This condition was accompanied by general feverishness, rigors, loss of appetite and a sensation of pervading malaise. In a severe attack the patient was rarely able to walk for three weeks, and after one attack passed off it was often followed by another of a milder type. In one case a gentleman was obliged to wear cloth shoes for upwards of eight months, and with other patients the system has been so impregnated with the poison that blisters have reappeared at intervals, not only on the feet, but on the hands, ears, etc., for more than three years. There was no doubt as to the cause and method of this blood-poisoning, for the blisters first came in stripes corresponding to the colored stripes of the stockings, and the laundresses complained of the irritation and inflamed condition of their hands after washing these poisonous articles. In another instance a crimson silk vest dyed in the same way was worn for two days with consequences very painful to the wearer. A Scotch lady brought a successful action against the firm which had supplied her with these goods; the manufacturers had a "scare," and it was formally announced that the employment of arsenic for dyeing wearing apparel would be abandoned. But that this abominable practice has been recommenced seems tolerably certain. And a recent case is mentioned, too, of a person who had a serious attack of blisters on his forehead, caused by a poisonous dye used for the lining material of his hat. The head is the most perilous point of attack, for this particular form of blood-poisoning, though it is not erysipelas, has a strong tendency to run into that painful, disfiguring, and dangerous disease."

To File a Square Corner.—The proper way to commence is, to do the edges first, and be sure you form a straight line, both on the edge and the edges or corners of the edge, on the oval or flat portion. This gives a starting point, and you will be able to go ahead without any trouble. If you commence in the right manner to file a piece of iron, the proper ways to finish the task will generally suggest themselves to you as you go along, if you properly heed your work and try to do it well. Don't work toward the corner; if you do, the more you file the less like a corner will it become. Work the reverse—from the corner. There is no difference, let it be a dash, dash-rail, seat-rail, seat-handle, and angular body loop, or what not, having a corner or angle, the same rule applies to all.—*Ex.*

One pound of gold may be drawn into a wire that would extend round the world.

INTERNATIONAL EXHIBITION, 1876.—UNITED STATES CENTENNIAL COMMISSION.

To the Editor of the American Artisan:

Sir,—The enquiries which reach this office show so insufficient an understanding of the International Exhibition that I have had prepared statements of some important items which it is desirable to make known.

I trust they will impress you as interesting to your readers, and that you will publish them for the general information of the public.

Very respectfully yours,
A. T. GOSHERN,
Director-General.

Philadelphia, Nov. 3, 1875.

ARRANGEMENTS FOR THE CENTENNIAL.

The act of Congress which provided for "celebrating the one hundredth anniversary of American Independence, by holding an International Exhibition of arts, manufactures, and products of the soil and mine," authorized the creation of the United States Centennial Commission, and entrusted to it the management of the exhibition. This body is composed of two commissioners from each State and Territory, nominated by the respective governors, and commissioned by the President of the United States. The enterprise, therefore, is distinctly a national one, and not, as has sometimes been stated, the work of a private corporation.

The exhibition will be opened on May 10, 1876, and remains open every day, except Sunday, until November 10. There will be a fixed price of 50 cents for admission to all the buildings and grounds.

The Centennial grounds are situated on the western bank of the Schuylkill River and within Fairmount Park, the largest public park in proximity to a great city in the world, and one of the most beautiful in the country. The park contains 3,160 acres, 450 of which have been enclosed for the exhibition. Besides this tract, there will be large yards near by for the exhibition of stock, and a farm of 42 acres has already been suitably planted for the tests of ploughs, mowers, reapers, and other agricultural machinery.

The exhibition buildings are approached by eight lines of street cars, which connect with all the other lines in the city, and by the Pennsylvania and Reading Railroads, over the tracts of which trains will also run from the North Pennsylvania and Philadelphia, Wilmington, and Baltimore Railroads. Thus the exhibition is in immediate connection with the entire railroad system of the country, and any one within ninety miles of Philadelphia can visit it at no greater cost than that of carriage-hire at the Paris or Vienna Exhibition.

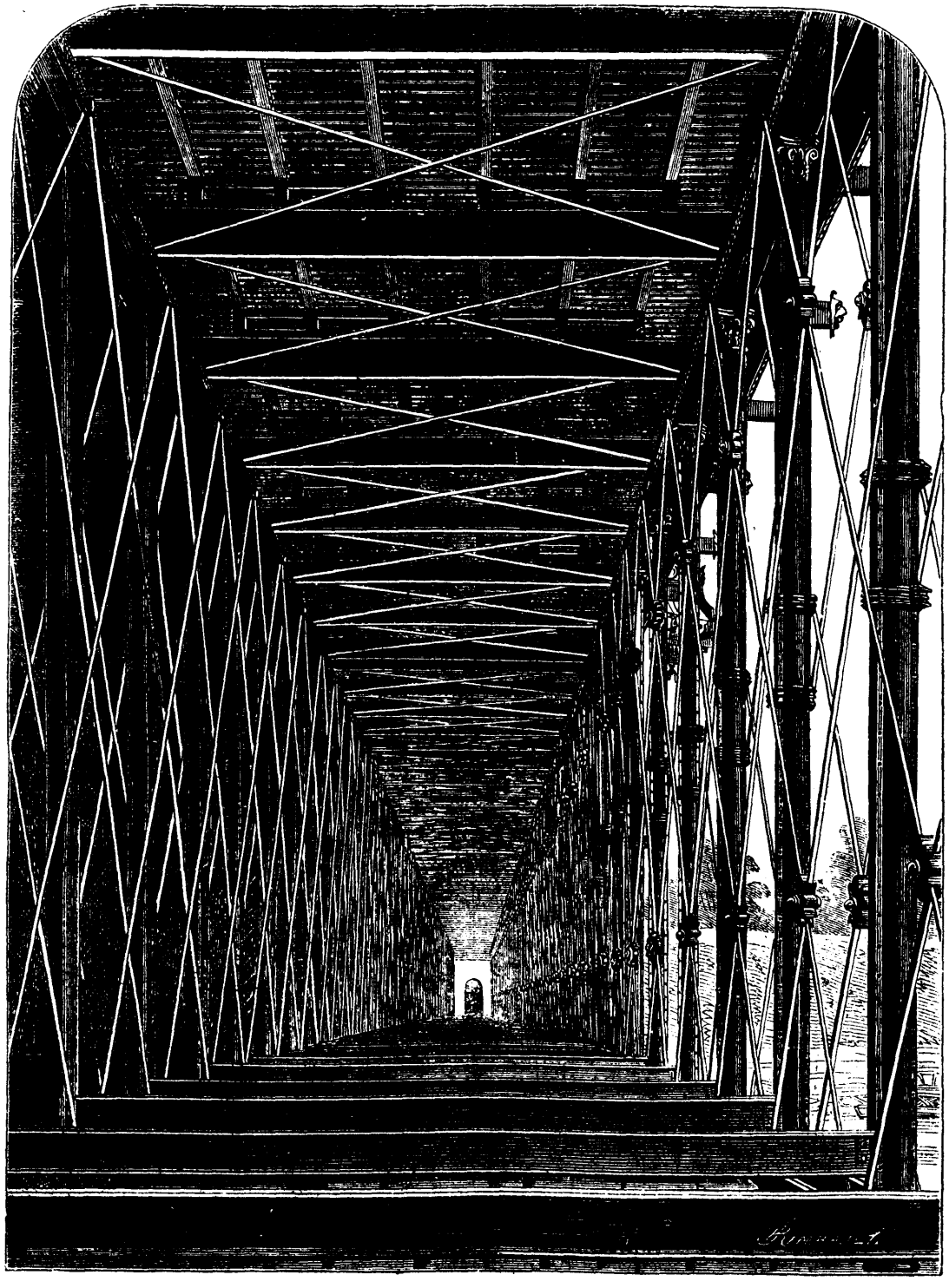
The articles to be exhibited have been classed in seven departments, which, for the most part, will be located in appropriate buildings, whose several areas are as follows:

DEPARTMENT.	BUILDINGS.	ACRES COVERED.
1. Mining and Metallurgy 2. Manufactures 3. Education and Science	Main Building.....	21.47
4. Art.....	Art Gallery.....	1.5
5. Machinery.....	Machinery Building...	14.
6. Agriculture.....	Agricultural Building..	10.
7. Horticulture	Horticultural Building	1.5
Total.....	.....	48.47

This provides nearly ten more acres for exhibiting space than there were at Vienna, the largest International Exhibition yet held. Yet the applications of exhibitors have been so numerous as to exhaust the space, and many important classes of objects must be provided for in special buildings.

An important special exhibition will be made by the United States Government, and is being prepared under the supervision of a Board of Officers representing the several Executive Departments of the Government. A fine building of 4½ acres is provided for the purpose, space in which will be occupied by the War, Treasury, Navy, Interior, Post-Office, and Agricultural Departments, and the Smithsonian Institution.

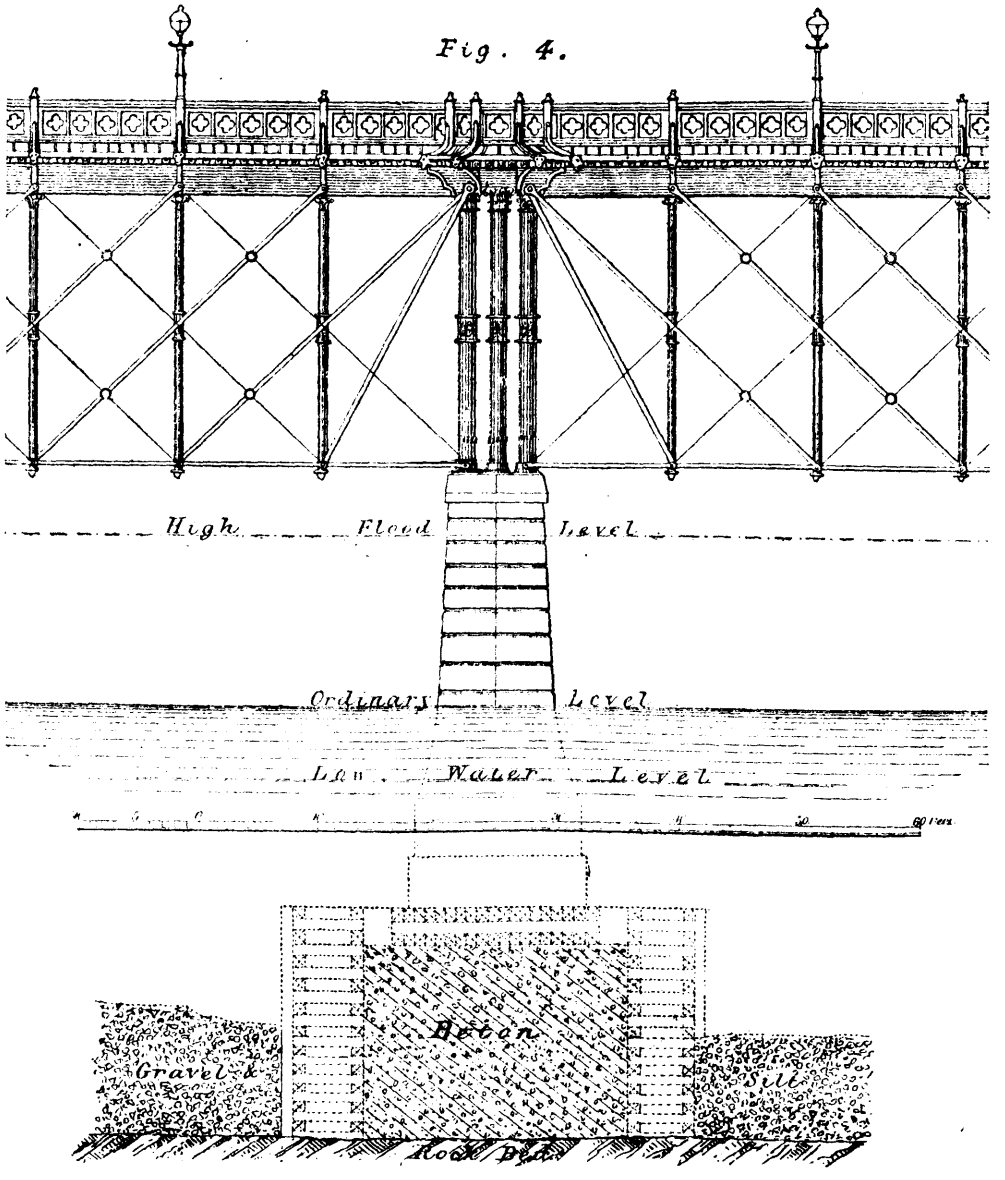
The Women's Centennial Executive Committee have raised $30,000 for the erection of a pavilion in which to exhibit every kind of woman's work. To this collection woman of all nations are expected to contribute.

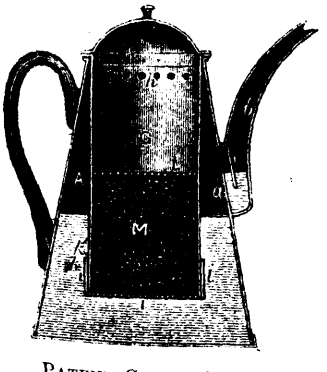


TRANSVERSE SECTION OF THE GIRARD AVENUE BRIDGE.

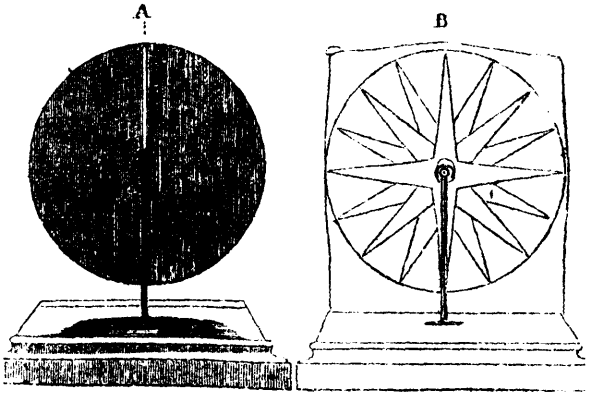
LONGITUDINAL DIAGRAM OF THE GIRARD AVENUE BRIDGE.

Fig. 4.





PATENT COFFEE POT.



ILLUSTRATIONS TO "LECTURES TO LITTLE FOLK."

The list of special buildings is constantly increasing, and present indications are that their total number will be from 200 to 250. Most of the important foreign nations—England, Germany, Austria, France, Sweden, Egypt, Japan, and others—are putting up one or more structures each, for exhibiting purposes, or for the use of the commissioners, exhibitors, and visitors. Offices and headquarters of this kind, usually of considerable architectural beauty, are provided by the States of Pennsylvania, Ohio, Indiana, Illinois, Michigan, New Jersey, New York, Connecticut, Massachusetts, New Hampshire, Missouri, Kansas, Virginia, West Virginia, Nevada, Wisconsin, Iowa, and Delaware; and it is likely that others will follow the example.

A number of trade and industrial associations, which require large amounts of space, will be provided for in special buildings. Among these are the photographers, carriage-builders, the glass-makers, the cracker-bakers, the boot and shoe manufacturers, besides quite a number of individual exhibitors. The great demands for space will probably render this course necessary to a considerable extent, especially for exhibitors who have been tardy in making their applications. In the Main Exhibition Building, for example, 333,000 square feet of space had been applied for by the beginning of October by American exhibitors only; whereas, the aggregate space which it has been possible to reserve for the United States Department is only 160,000 square feet, about one-third of which will be consumed by passage-ways.

The Machinery Building, like the others, is already fully covered by applications. There are about 1,000 American exhibitors in this department, 150 English, and 150 from other European countries—which is about 350 more than entered the Vienna Machinery Exhibition. Extra provision is being made for annexes to accommodate the hydraulic machinery, the steam-hammers, forges, hoisting-engines, boilers, plumbers, carpenters, etc.

Power in the Machinery Hall will be chiefly supplied by a pair of monster Corliss engines. Each cylinder is 40 inches in diameter, with a stroke of ten feet; the fly-wheel is 31 feet in diameter, and weighs 55 tons; the horse-power is 1,400; and the number of boilers is 20. This engine drives about a mile of shafting.

For the Art Exhibition the most eminent American artists are understood to be at work, and it may be confidently stated that, especially in the department of landscape painting, the United States will present a finer display than the public has been led to expect. Quite aside from the contributions of American artists, applications from abroad call for more than four times the exhibiting space afforded by the great Memorial Hall. Provision for the surplus will be made in temporary fire proof buildings, though all exhibiting nations will be represented in the central Art Gallery.

The Secretary of the Navy has arranged that a United States war vessel shall call next spring at convenient European ports to collect and transport hither to the exhibition the works of American artists resident in Europe. Among the ports thus far designated are Southampton for England, Havre for France, Bremen for Germany, and Leghorn for Italy, to which, if desirable, others may be added.

Mr. Bell, the eminent English sculptor, who designed the groups for the plinth for the Albert Memorial in Hyde Park, London, is reproducing in terra-cotta, at the celebrated works in Lambeth, the one which symbolizes America. The figures in this group are colossal, covering a ground space of fifteen feet square. It will probably be placed in the great central gallery, opposite the principal entrance.

The Art Exhibition will include, in addition to the works of contemporary artists, representative productions of the past century of American art—those, for instance, of Stuart, Copley, Trumbull, West, Alston, Sully, Neagle, Elliot, Kensett, Cole. These, as well as the works offered by living artists, will be passed upon by the Committee of Selection, who will visit for the purpose New York, Boston, Chicago, and other leading cities, in order to prevent the needless transportation to Philadelphia of works of art not up to the standard of admission.

A large number of orders and fraternities have signified their intention to hold gatherings at Philadelphia during the period of the exhibition. Among those which may now be enumerated are the Grand Lodge of Pennsylvania, Independent Order of Odd Fellows; the Grand Encampment, Independent Order of Odd Fellows; Grand Lodge United States, Independent Order of Odd Fellows; Grand Commandery Knights Templars; Grand Army of the Republic; Presbyterian Synod; Caledonian Club; Portland Mechanic Blues; Welsh National Elstedfood; Patriotic Order Sons of America; California Zouaves of San Francisco; an International Regatta; the Life Insurance Companies; National Board of Underwriters; State Agricultural Society; Second Infantry, N. G., of California; Philadelphia Conference, Methodist Episcopal Church: Cincinnati Society; California Pioneer Society; American Dental Convention; Catholic Total Abstinence Union of America; Independent Order of B'nai Berith; National Alumni Association; Salesmen's Association; Fifth Maryland Regiment; American Pomological Society; Maister's Association of the United States; Army of the Cumberland; Humboldt Monument Association; Christopher Columbus Monument Association; Board Trade Convention; International Typographical Congress; Rifle Association of the United States; Centennial Legion; Philadelphia County Medical Society; International Medical Congress; Old Volunteer Fire Department of Philadelphia.

McFARLAND'S IMPROVED COFFEE-POT.

(See page 45.)

Mr. N. S. McFarland, No. 737 Broadway, New York City, has invented and patented through the American Artisan Patent Agency an improvement upon the coffee-pot illustrated and described on page 205, current volume. This improvement is illustrated in the accompanying engraving. In addition to the convenient leaching apparatus in the centre of the pot, described in our former article, he now places a trap in the base of the spout, as shown in the engraving. This trap is closed when coffee is to be made by pouring a spoonful or two of water into the nose of the spout. Thereafter it will keep closed during the pouring of the coffee. Its action is to prevent totally the escape of the aroma. Not the slightest smell indicates that the making of coffee is progressing. Decidedly the finest coffee that we have tasted for years is made in one of these pots, which we are using in our own domestic establishment with the highest satisfaction.

STEREOTYPES FOR NEWSPAPERS.

A new method of supplying newspapers with matter introduced by M. J. Hughes, of New York, consists in setting in type articles of a miscellaneous character, suitable for the general news and literary departments of country newspapers, stereotyping, by the paper process or otherwise, a number of plates in columnar form, and sending by express to each paper desirous of using such matter, one plate of each article set in type. By this means, the publisher of a paper of small circulation can be supplied with matter at a little above the cost of stereotyping, and can thus give his patrons a much more readable paper than if the type had to be set up especially for his use. Ths stereotypes are formed of a standard size that will admit of their being used without much adjustment, and are made of different styles; some are cast around a block of wood to lessen the weight of metal, and are made exactly "high type" so as to require no blocking or adjustment, except possibly a "lead" or two, or a "reglet" on each side, should the columns of the paper be wider than the standard size adopted. The later style proposed is double-faced plates, so that the stereotype may be used in one form for one side of a paper, and then taken out, reversed, and used in the other form for the other side.

NOTES AND MEMORANDA.

According to the *Scientific American*, the angular velocity of clouds is determined by M. Hursau de Villeneuve in the following way: He takes a ball of silvered glass, on which he draws with ink an equator and equidistant meridians. He places the sphere so that, the axis being horizontal, the cloud may be seen, by reflection, displaced along the equator traced, and then the time which it takes to go from one meridian to the next gives the angular velocity.

To the list of substances capable of furnishing illuminating gas of good quality, cork is now to be added. Recent experiments made in Bordeaux, says the *Scientific American*, have given results both economical and satisfactory, and it has been definitely decided to use the material in the lighting of the city. Works for burning cork are now in process of construction. The fragments of cork, principally waste left after cutting bottle stoppers, are distilled in a close retort. The flame obtained is stated to be whiter and more brilliant than that of coal gas, while the blue zone is much smaller, and the density considerably greater.

THE ATTEMPT TO RUN FROM NEW YORK TO PITTSBURG IN TEN HOURS.

Last week we noted the fact that the Pennsylvania Railroad had just completed a monster engine intended for this work. We take from the Pittsburg *Commercial* the following account of the first trip:

The train left the depot in Jersey City at seven o'clock on the morning of the 9th. It consisted of two passenger coaches and one baggage-car, drawn by the monster engine No. 573. The baggage-car was divided into two compartments—one for coal and the other for water. The coal was filled in sacks and the water in hogsheads. About 150 bushels of coal were provided for the trip from New York to Pittsburg. Only about four hogsheads of water were taken on board, as most of the water-supply was obtained from the troughs along the route without stopping. The party consisted of General Manager Frank Thomson and other officials, the party numbering about 100. The crews designated to run the train on the different divisions were sent to New York a day or two before its departure, it being the intention to make the run without making a stop. The distance from New York to Pittsburg being 444 miles, the average speed required would be about 44 miles an hour.

The train reached Philadelphia at 9.15 a.m., the time prescribed by the special schedule. At 10.25 a.m. it had reached Pomeroy, a station between Coatesville and Parkersburg, about 44 miles west of Philadelphia. At this point an accident occurred which caused an abandonment of the project. C. S. Douglas, assistant road-foreman of engineers, while leaning from the platform of one of the coaches, was struck on the head by a projecting roof of a milk-depot and instantly killed. The train stopped and took the dead body on board, bringing it on to Harrisburg, losing twenty-three minutes. At the last-named city another stop was made for the purpose of leaving the body of the unfortunate Douglass, and the train being now more than half an hour behind time, it was found necessary to abandon the original programme.

No further attempt being made to comply with the schedule, the train was an hour and a half behind time when it arrived at the Union depot. Notwithstanding the lateness of the hour of arrival, a large and excited crowd was in waiting, and the railroad officials who came on the train were surrounded and subjected to divers interviews touching their experiences *en route* from the metropolis.

A representative of the *Commercial* questioned a number of the leading officials of the road as to their prospect of carrying out the ten-hour programme. They all express themselves as confident of their ability to make the time, and say that another attempt will be made as soon as the annual road inspection, which will be commenced to-day, is completed. The next trial will probably be made about the 23rd inst.

WHY DO NOT PORTRAITS ALWAYS LOOK LIKE THE SITTER?

The *Manufacturer and Builder* answers the question as follows: A very common cause is the improper illumination of the features while the picture is being taken. Different faces require different kinds of light to bring out the characteristic features, which are different in every individual; some require the light sideways, some more from above or below, others in front or more from behind; and if the photographer is a portrait painter, or at least an artist, he will know how to manage the light and illuminate the face of the sitter in such a way as to show the prominent characteristic features, and at the same time show the face to the greatest possible advantage. As a photograph consists of nothing but lights and shades, every phase of light and shadow as it falls on the face of the sitter is reproduced with the utmost fidelity.

In order to see the force of these remarks, one has only to look at the face of a person in the evening in a room lighted up by a single candle, and watch the changes in the appearance of the face when moving the candle, keeping it above the face, or at the side, or in front, or below. Unfortunately most photographers have no idea of all this, and have a fixed light—usually a skylight, which is indeed the worst to bring out any face to advantage; or they place every customer so as to face the light, and take his picture in front from the side where the light comes from; the result is a flat picture, without character, and having only a faint resemblance. There are many galleries where the lights cannot be so managed as to give the kind of light needed for some countenances, and it is in such galleries that certain kinds of faces cannot be taken satisfactorily.

Most of the leading photographers have commenced to see the great advantage of being able to obtain the light also from the side, and even from below, and to be able to screen the top light with proper curtains; hence the really fine artistic pictures obtained nowadays by those photographers who, being artists themselves, are foremost in this beautiful art.

MEDIÆVAL WROUGHT IRON ENTRANCE GATES IN FRONT OF PARLIAMENT BUILDINGS, OTTAWA,—H. R. IVES & CO., MONTREAL, P. Q.

(See page 49.)

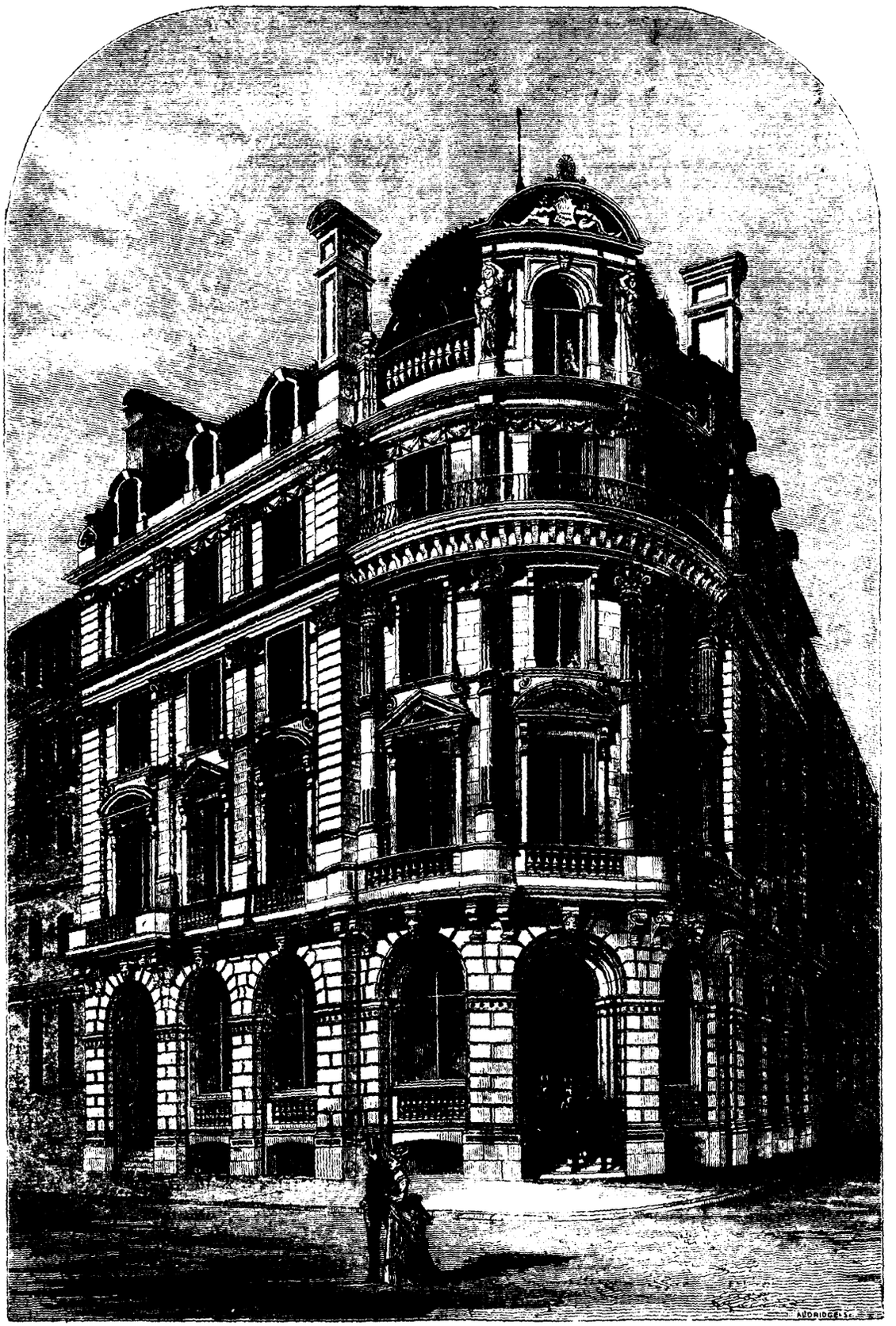
The three beautiful gates and fence which adorn the spaces in front of the Parliament Buildings, challenge the admiration of every beholder, recalling as they do an art almost lost. At a time before the age of cast iron, the most beautiful metal work the world has ever seen, not even excepting those in the precious metals, were executed in wrought iron by the hands of very great artists—such as Quentin Matseys, Their works exhibited the greatest variety, from the most delicate grille work for interiors, to that of the most massive in the form of gates to protect a city. We are all most or less accustomed to the beautiful hammered hinges which are to be seen on most church doors, but until now we have had no such specimen of iron work as is here before us. The magnificent span of the centre gate is 22 feet wide, divided into panels by twisted columns surmounted by pointed and cusped arches, these panels having in the centre rich pieces of scroll work of symmetric design, exhibiting conventional leaves and flowers. Each compartment is terminated by a finial, and in the centre rises boldly a beautiful piece of foliated scroll work. The lower portion of the gate is more massive in character as befits its position. The whole, as may be seen, forms a rich and striking addition to the Parliament Buildings, as well as reflecting no small credit on the Montreal firm whose enterprise prompted them to bring to the country and retain workmen of such excellence and skill.

HOW OLD IS MAN?

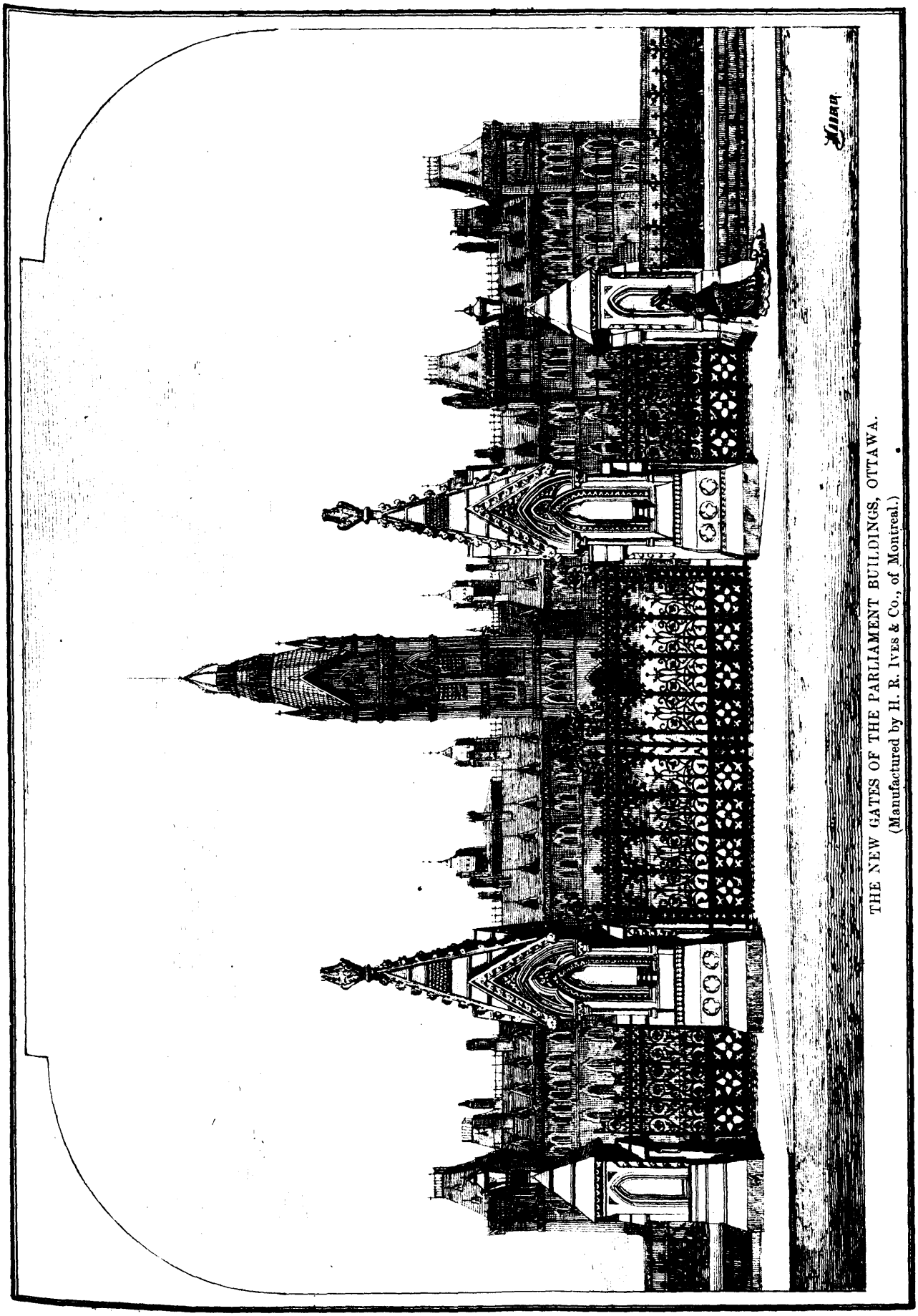
With exceeding accuracy from the lacustrine habitations of man found in Switzerland, the evidences are almost positive that they were built some 5,000 to 7,000 years ago, and a wide margin for error is allowed. At sixty-five feet deep in the Nile alluvium, fragments of brick have been found. Calculations of how long it has taken the Nile mud to deposit to such a depth were not difficult. In a century the data were almost positive that 3½ inches represented the thickness of the deposit. Sixty feet then represented a period of 30,000 years, according to M. Rosiere. Agassiz, when studying human remains found in Florida, coming from a lacustrine structure, declared them to be fully 10,000 years old. A human skeleton discovered under four buried forests seems to point to an age of 50,000 years ago.

But these traces of the antiquity of man, whether positive or not, are as if but of yesterday, in comparison with other evidences which are much more definite in character. In Torquay is Kent's Cavern. It is a cavern where stalagmites are constantly forming. The carbonate of lime dissolved in water containing an excess of carbonic acid, dripping through the upper surface of the cave, is deposited as solid carbonate of lime. This simple chemical process, though constant, is a very slow one, a pellicle or film of lime being formed of exceeding thinness. In this particular cave where this process has apparently been going on forever, names of persons which have been cut two hundred years ago into the stalagmites are still visible, though covered over by a coating or varnish of fresh carbonate of lime. Very careful estimates of how long it would take to form an inch of stalagmite led the British Association to determine that a foot could be only produced in 20,000 years. Now, far below the stalagmite floor, specimens of man's handicraft have been found.. At the very lowest estimate, the flint weapons in Kent's Cavern were made half a million of years ago.—*Science Record.*

CURE FOR RHEUMATISM.—"E. P. B." writes:—"This complaint is likely to be very prevalent this damp, cold weather, and I am induced to send you a very simple remedy, which I am told by a lady friend is most effectual, she and others having proved it. It is merely a little powdered sulphur dusted into the boots. I do not know that it is a novelty, but as some of your readers may not know of it, you may think it worth inserting."



LONDON STREET ARCHITECTURE.



THE NEW GATES OF THE PARLIAMENT BUILDINGS, OTTAWA.
(Manufactured by H. R. Ives & Co., of Montreal.)

HEDLEY'S APPARATUS FOR RAISING AND LOWERING LAUNCHES.

(See page 52.)

Mr. Robert Hedley, of North Greenwich, has recently patented an apparatus for raising and lowering steam launches expeditiously and safely over the sides of ships and wharves. The mode by which this desirable consummation is proposed to be effected is at once ingenious, simple, and—in view of its permanent value—inexpensive. The arrangement devised by the patentee for thus handling the small craft in question, as well as ships' boats of all descriptions, will be generally understood from an examination of the accompanying illustrations, but in order to make the plans of Mr. Hedley more completely intelligible we shall describe them in detail. Undoubtedly the distinguishing feature of the apparatus is the application to it of hydraulic force. The drawings, Fig. 1 and 2, exhibit the apparatus with launches attached. In Fig. 1 the miniature steamer is represented as suspended after being raised from the water, and prepared for swinging on board, and in Fig. 2 as having been lowered into her native element and ready for a start. In both cases the launches are shown "stern on" to the side of the vessel, and in this position they are always deposited in the sea by means of the Hedley contrivance.

It will be seen that the upper part of the apparatus is constructed somewhat similarly to an ordinary swing crane when mounted on a ship's deck. Below, however, the arrangements are of a totally different character, and for the sake of clearness they are illustrated in section. Projecting downward from the base plate, which of course is firmly bolted to the deck of the vessel, is a barrel of gun metal or iron G. Inside the barrel is a tube of smaller dimensions, and which is free to revolve. The upper end of a swivelling cylinder is made to support standards, and to these latter a rock beam of double-ended lever I is suspended by trunnions. One end of the lever is of greater length than the other, and this has a "horse head" or triangular frame O attached to it. Thus when the long end of the lever turning on the steel pin sustained by the cheeks A A is lowered, the triangle falls over and extends, as it were, the length and range of the lever. The long arm of the rocking beam, as it may be termed, is connected by means of a rod to a piston within the inner or hydraulic barrel F, and which may be moved upward or downward by the force of water pumped in by hand or steam power. The short arm of the main beam is also connected, by a chain H, to a small piston D within the inner tube. The water admitted to the latter thus acts against the faces of both pistons intermediately and forces them apart. In this way when a steam launch or boat, or indeed a weight of any kind, is being lifted, the hydraulic force is exerted, by a duplex action, on both ends of the beam simultaneously but in opposite directions. The combined effect, however, is to pull down the short end, and to push up the long end of the rocking beam with the weight attached to it.

Whilst the lift is thus taking place the triangle is made to move over a short radius, and thus to bring the body suspended nearer to the side of the ship, as well as to increase the height to which it is raised. In fact, if it be a launch or boat in the slings, her keel will be thus brought above the gunwale of the ship, so as to leave her free from swinging on board. When shipped, the launch, according to Mr. Hedley's plan, is stowed athwart the vessel about midships, so that she can readily be swung "end on" and again lowered into the sea. The lowering itself is effected readily by one man seated in the boat, and who by pulling a cord opens a valve, and thus allows the water in the barrel to flow back at an adjustable speed to the pump tank. Gently thus the boat is seated again on the water, and being disengaged, she is ready for steaming or rowing straight off, without the risk of being swamped by the waves, as often happens under the present method of lowering boats and launches—namely, broadside to the ship. In the case of boat lowered as now proposed, "end on," every oar can be shipped, or in the case of steam launches the steam may be got up and the engine started before the boat touches the water at all.

The hydraulic pump for charging the inner barrel may be fitted on the spot on a ship's deck found most convenient for the purpose, but it ought to be close to the swinging apparatus for facilitating operations. The disengaging may be made to take place automatically when the boat touches the water, or by a very simple hand arrangement. An air buffer is made to act as a brake and regulate the angle at which the long arm of the beam shall stand when projecting over the side of the vessel. That angle is determined by weight suspended.

The long arm of the apparatus, having a preponderance of weight, descends, by reason of its own gravity, when the relief valve of the inner barrel is opened, the short arm, of course, rising at the same time. The two pistons thus approach each other, and are left ready to be separated by hydraulic means when a raising has again to be effected.

The chain arrangement for swinging a launch is so contrived as that she shall always be maintained at a dead level, and this constitutes a not unimportant, although a minor, feature of the boat raising and lowering apparatus of Mr. Hedley. In fact, it seems clear that the patentee has brought his extensive practical experience to bear on the work of making the invention as complete and perfect as possible, and that he has not exerted himself altogether in vain. He claims to have devised the readiest and most effective means of accomplishing the object desired.

IRON-CLAD VESSELS.

The invention of iron plates to protect vessels is far from being of as recent date as is generally supposed. During the 12th century, the Normans covered their ships, from the waterline up, with an iron casing, terminating in a ram on the bow. Still earlier, they had adopted a system of protecting the upper works with metal shields. In 1534, Peter of Arragon ordered his ships to be iron-plated, in order to protect them from the burning missiles then in common use. In 1530, the squadron of Andrea Doria contained a vessel built by the Knights of St. John, which was armored with several thicknesses of iron. At the battle of Lepanto, several ships protected their batteries with bars of iron. For two centuries, no progress seems to have been made. In 1782, at the siege of Gibraltor, an engineer officer constructed six ships, which were the types of the modern iron, clads. They were covered with an armor of hard wood, leather and bar-iron. It is said that they resisted the fire of the forts for a long period, but were finally sunk by red-hot shot.

To Coat Small Nails with Tin.—Put half an oz. of powdered tin (which may be procured of any operative chemist) into a common Florence flask; pour on about 2 oz. of concentrated muriatic acid, and boil over a spirit lamp until the tin is dissolved. When cool, pour into any convenient vessel, and dilute with about an equal bulk of pure water. Drop in the nails required to be coated, holding the vessel so they may all fall to one side. Immerse a piece of sheet-copper into the solution, as far apart from the nails as possible, and connect it with the latter by means of a piece of copper wire. The effect of this arrangement is the development of a voltaic electricity, which causes a rapid decomposition of the fluid, and the deposition of tin on the surface of the nails. After being subjected to this treatment for about an hour, the nails will be found to have received a thick coating of metal, and may then be removed from the liquid, dried and polished. *I have frequently had recourse to the above process for the purpose of coating the nibs of steel pens with tin, in order to prevent them from rusting*, and have always found it succeed better than any other method I have tried.

A New Theory of the Nebulæ.—M. Plante has recently communicated to the French Academy of Sciences the results of some experiments which may lead, it is believed, to a new theory for the circumstances to which are due the spiral forms of many of the nebulæ. The experiments consist in the exact reproduction of these forms by the combined action of electricity and magnetism. Two copper electrodes of a battery of fifteen elements, being plunged in water acidulated to 1-10 with sulphuric acid, the end of the positive electrode is brought to one pole of the magnet. The cloud of metallic matter carried from the electrode by the current at once assumes in the liquid a gyratory spiral movement, of which the general disposition strongly recalls that of the nebulæ. The investigator is proceeding with further experiments in the light of this idea.—*English Mechanic.*

The Largest Steam Hammer.—There seems to be scarcely any limit to the power and weight of steam hammers. As soon as the largest is built, another, still larger, is immediately undertaken. The latest whose immediate construction is announced has been projected by Krupp, which will be capable of beating up a mass of steel weighing 100 tons, and will cost one million of dollars.

FROST BITE.

Exposure to the cold, of severe degree, often leaves the fingers and toes, nose, ears, and lips, more or less frozen. This condition, short of absolute *death* of the part, is termed Frost Bite. It will be observed that the portions of the body just enumerated are those most exposed, in area, to the influence of the cold, and are furthest situated from the heart; and it will, perhaps, be unnecessary to remark that persons who are *delibitated* are more apt to suffer with the same amount of exposure than the *robust*.

When the circulation of any part begins to succumb to the influence of the cold, it becomes puffy, blueish, and smarting. This is because the blood moves more slowly than natural through the vessels exposed near the surface. Soon this blueness disappears, and the part becomes pallid, as if the influence of the cold had contracted the vessels to an extent incompatible with the passage of blood through them. The *pain* at this point ceases; indeed, until he meets a friend, he often does not know of his mishap. At this stage the injury has become so great that, unless proper means are taken to restore circulation, complete *death* of the part ensues, and in due time sloughs away, and is detached from the line of living tissue.

What takes place in a *part* of the body, known as Frost Bite, may take place in the *whole* of it, which is known as "Frozen to Death." The blood of the extremities being gradually forced from them, under the continued subjection to the cold, is forced inward upon the larger blood vessels, heart, lungs, and brain. There is increasing difficulty in breathing, owing to the engorged state of the chest, and, what should always be remembered by one so exposed to cold, an *unconquerable desire to sleep*. To sleep *then* is to die. If the person exhibits such a symptom he must, by all means, be kept constantly moving.

Treatment.

Persons exposed like those just described must be treated promptly, and with one thing never lost sight of. That is, keep the frozen person away from the heat. A person taken up insensible, or approaching it, from exposure to the cold, should be taken into a *cold* room, his clothing removed, and thoroughly rubbed with snow, or cloths wrung out with ice water. The friction to every part of the body, particularly the extremities, must be continued for some time, until signs of returning animation appear. When the frozen limbs show signs of life, the person should be carefully dried; put in a cold bed in a cold room; Artificial Respiration used until the natural warmth is established; then brandy given, also ginger tea, and beef tea. Usually, by this time medical advice will have been secured to direct further treatment. Should it not, do not forget that the patient is to be brought by degrees into rather warmer air; and lest in some *part* there might still be defective circulation, the person should be kept away from exposure to the heat of the fire.

Milder degrees of the same condition, as suspension of life in the ear, nose, finger, or toe, from exposure to cold, must be treated with the same general directions in view. The part should be kept away from the heat, and rubbed with handfuls of snow, or towels dipped in cold water, until circulation appears re-established. Exposure of the part to the heat before, we may say, it has been almost *rebuilt*, is apt to be followed by *sloughing*.

Rail-rolling Extraordinary.—The capabilities of the steel-works belonging to the Ebbw Vale Company have just been tested. A few days ago arrangements were made by Mr. J. J. Richards, manager, for the rolling of two steel rails of extraordinary length, weight, and quality. The first rail brought out was a T head rail, and its length is 74 ft. 6 in.; it weighs 16 cwt. 6 lb. The length of the second rail, a double-headed one, is 89 ft. 7 in. The weight, calculating 78 lb. per yard, is 1 ton 3 qrs. 14 lb. Both rails are good specimens of workmanship. These rails are stated to be the longest and heaviest ever rolled.—*Builder*.

Smoke-Washing Apparatus for Factory Chimney.—An apparatus for washing smoke, and so depriving it of its character of a nuisance, is in operation at a factory at Menilmontant, Paris. A fine shower of water, travelling in the direction of the smoke, and at five times its velocity, is projected into the chimney, where it mixes with the smoke, taking up the soluble gases, and precipitating the impurities carried up with the smoke by the draught. The foul water is discharged into a cistern, where it is collected, and a fine black paint is got from it. The arrangement is not a novelty in England.—*Ibid.*

FACTS AND FANCIES.

By the rapid motion of our globe, a person is conveyed a hundred miles while counting one, two, three, four, five, ticks of a clock! A railway carriage, running at the same rate, would travel round the globe in twenty minutes.

It has not been determined whether the earth is a solid body, or a shell; it is too large a nut for our intellectual crackers, and we cannot conveniently shake it to hear if it rattles, nor thump it so as to know whether it is an empty vessel.

If all the planets of our solar system were put together, and rolled into one ball, they would not form a globe that would be one five-hundredth part the size of the sun. Thus, if the reader has ever thought of our earth as a world of the chief consequence in creation, he has made a great mistake.

Telescopes have been made of such magnifying powers as to enable those using them to detect buildings or works, if there were any, in the moon, so large only as Westminster Abbey; so that anything like cities, or roads, or masses like armies, for instance, in motion, would easily be seen. But nothing of the sort appears to the keenest eye.

The planet Mars is comparatively a small globe, and his attractive power is, therefore, correspondingly weak. A man walking there would have lost two-thirds of his weight, and would scarcely seem to press the ground. Flying would be very easy.

In the planet Jupiter, whose diameter is 87,000 miles, a man, could he exist thereon, would find his weight increased eight times. He would probably tumble down, and be unable to raise his head; for this reason, that the weight of bodies is affected by the size and weight of the planet on which they exist.

In the same planet, (Jupiter) a man would see the sun very much reduced in size, but his apparent motion would be so much increased that he would seem to be rolling visibly through the heavens; in five hours he would have performed his whole day's journey, and then there would be one, two, three, four, moons rising, one after another, running also a swift race through the skies—new moons, half moons, full moons, and so on; and there would also arise another splendid object—Saturn, with his rings and lunar attendants. But this, too, with all the starry hosts, would swiftly disappear, and after a short night of five hours, the sun would rise again, and give another brief day.

Jupiter is thirteen hundred times as large as the earth; so that if we were to take this measurement strictly, and estimate the stature of the presumed inhabitants in proportion, the height of a Jovian would be about a mile and a quarter! he would take about three steps to a mile in walking, and it would be almost half a mile from hand to mouth! Why should it be more wonderful that an inhabitant of Jupiter should be thirteen hundred times bigger than I am, than that I should be thirteen hundred times bigger than a mouse, or thirty thousand times bigger than a fly?

Suppose our earth had been square, it would have been impossibility for us to stand upright, or on any one of its sides, except in the very middle of each, and from this centre it would have been *up-hill* every way. The corners of the square would have been like so many immense pyramids, or mountains, which, if any one could have ascended, he would then have looked on these vast sloping plains, down any of which he might, if his foot had slipped, have rolled thousands of miles without stopping! The corners of the earth, moreover, would have neither water or air.

The ocean, according to geographers, is contained in five great basins—not mere "nut-shells." They are rather sizeable dishes which hold the Atlantic, the Pacific, the Arctic, and the Antarctic oceans! We may add that they are all *earthen* basins, and that the Eastern sea is contained in a *China* one!

The same iron ore furnishes the sword, the ploughshare, the pruning-hook, the needle, the graving tool, the spring of a watch, the chisel, the chain, the anchor, the compass, and the cannon-ball. It is a medicine of great utility, and the only metal friendly to the human frame.—*Family Friend.*

Silver is, perhaps, more useful for coin than for any other purpose. What should we do with a gold sixpence, or a copper half-crown? One would be as big as a flattened pin's head, the other the size of a frying pan; very convenient for an old ploughman's canvass bag, or for a lady's pocket!

FIG. 1.

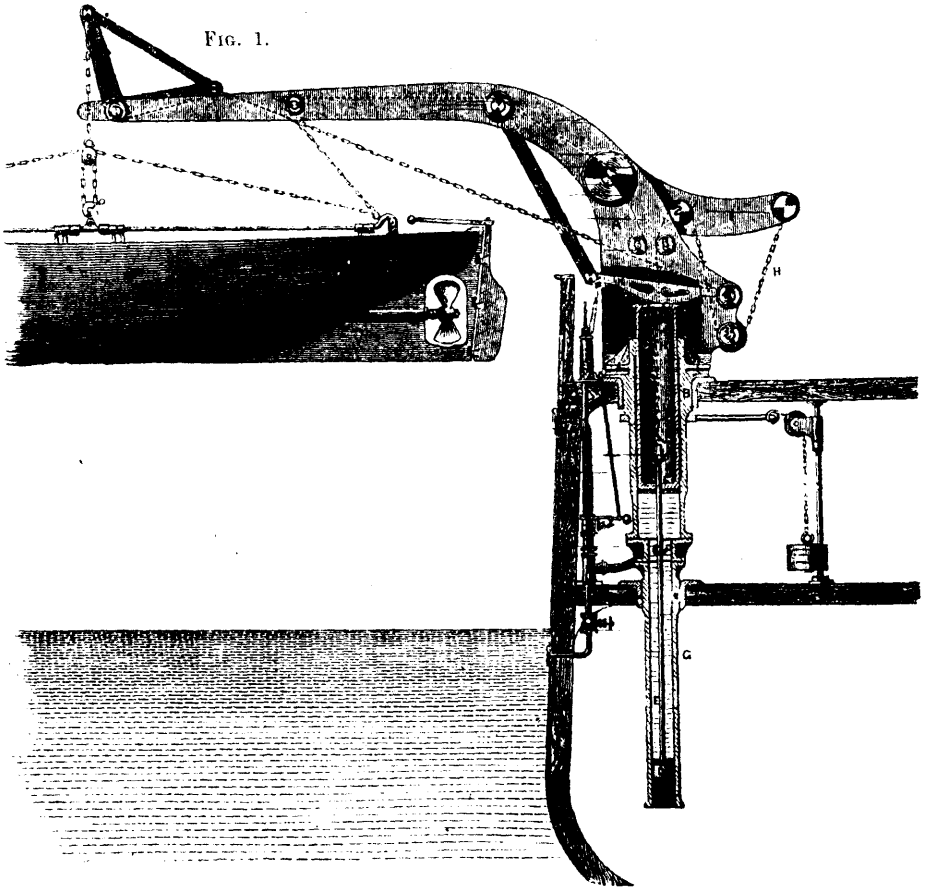
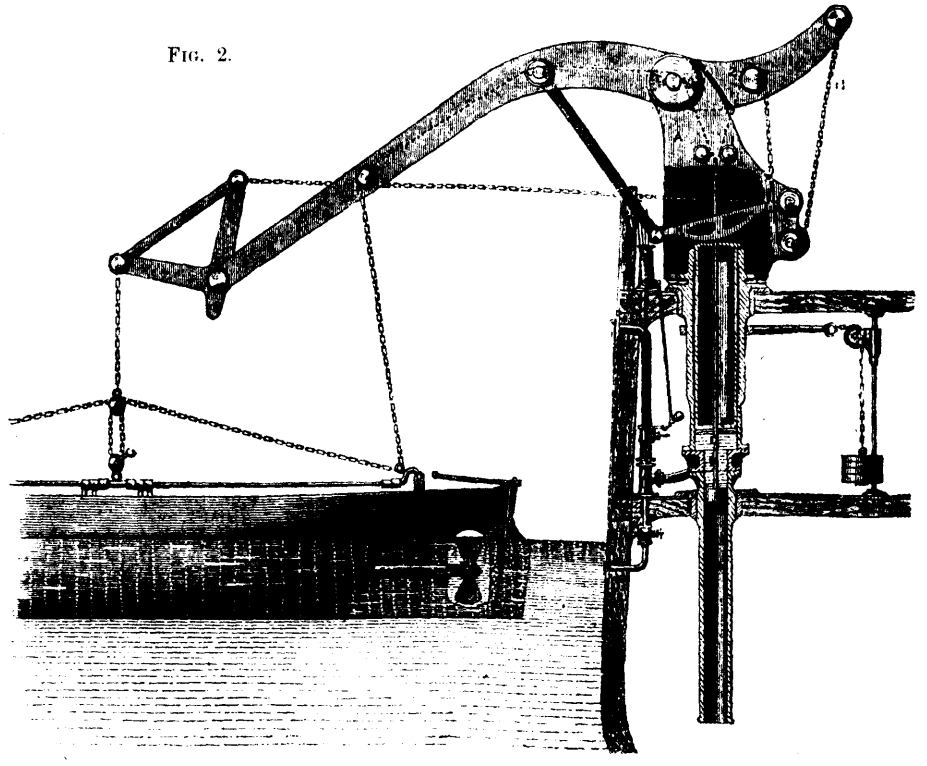
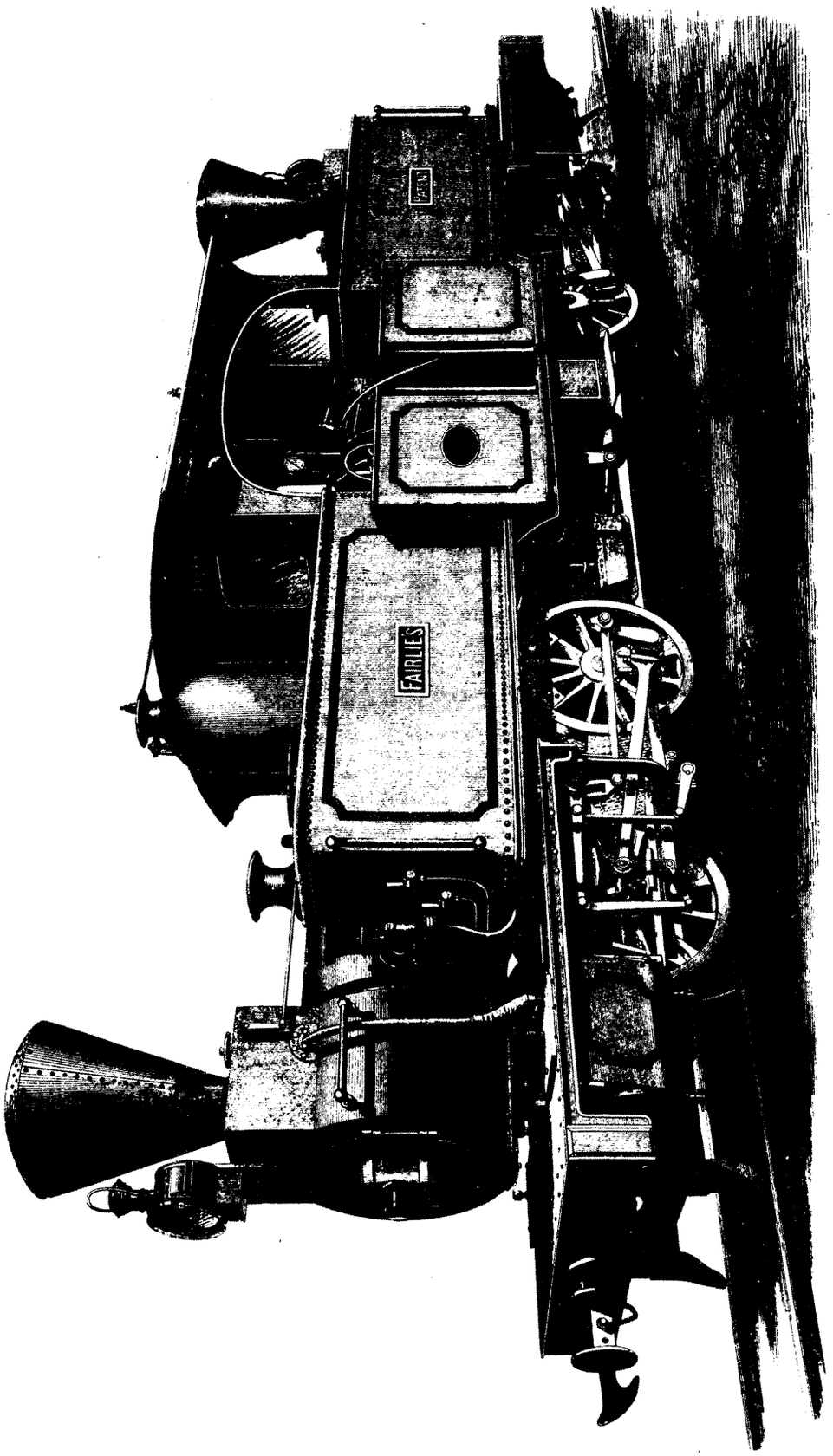


FIG. 2.



HEDLEY'S APPARATUS FOR RAISING AND LOWERING LAUNCHES.



DOUBLE DOGIE LOCOMOTIVE;—FAIRLIE'S PATENT.
(For the New Zealand Railway.—Gauge, 3ft. 6ins.)

TOWN HALL, VICTORIA, B. C.

(See page 57.)

This is the principal elevation on Douglas St., of the first premiated design, for the Victoria City Hall, about to be erected, under the superintendence of the successful competitor, Mr. John League, architect. The accommodation provided in this building will comprise in the basement Corn Market, Engineers Fitting rooms, store rooms, prison cells, hot air apparatus, &c. On the ground floor has been placed the police court, the public entrance of which will be by Pandora St. A private entrance to magistrate's and other rooms will also be on this street. Communication by private stairs, from court room to cells, is also provided for, waiting rooms, court officer's rooms, &c. The large Hall is approached from two separate entrances. The principal entrance will be from the entrance hall on Douglass St., and a secondary entrance and staircase leading to the gallery will be from Cormorant St.; also private entrances, retiring rooms, &c. The size of the large Hall will be 40 x 80 and 34 feet high.

First floor contains council chamber, mayor's reception rooms, committee rooms, city clerk's office, water commissioner, assessor, fire-proof room, &c.

Second floor contains city surveyor's rooms, map room, stationery, jury rooms, museum, care taker's rooms, &c. In the rear of the main building will be a two storied building for the fire engine house, a building for meat and poultry market &c. It is proposed to warm the building by hot air. The picture was photographed by Mr. Noah Shakespeare, Victoria.

To Mend Iron Retorts.—Fire clay 15 lbs., saleratus, 1 lb. with water sufficient to make a thick paste. Apply to the broken part of the retort while at a good working heat, then cover it with a fine coal dust, and charge the retort for working.

To Stop Leaks in Clay Retorts When at Working Heat. Five parts fire clay, 2 parts white sand, 1 part of borax pressed and ground. Mix the whole together with as much water as may be necessary to bring it to the consistence of putty. Roll it in the hands to a proper length and apply it over the crack, pressing it with a long spatula into the crack.

To Prevent Gas Meters From Freezing.—Half a pint of good glycerine is said to prevent the freezing of 1 gallon water, though at least double the proportion is preferable in the country, whatever the temperature in the winter may happen to be.

Magnetized Watch Works.—The only cure is to put in a gold or brass balance and new pendulum spring. The most intense heat will not eradicate the trouble.

Cement for Leather.—Bisulphide of carbon, 5 ounces; tick, gutta percha, 1 ounce. The latter is like thin curly shavings of leather and must be added a little at a time. Cork up tight, and it is fit using in 10 or 12 hours.

To Repair Leakages in Fire Engine Hose.—Pass a round bar of iron into the hose under the leak, then rivet on a patch of leather, previously coated with marine glue.

Aquaria Cement.—Mix equal quantities of dry white lead and red lead to a paste with mastic varnish, and use as soon as mixed.

New Steam Packing.—Take long coils of continuous strands of flak or hemp loosely twisted, or better still, with scarcely any twist, saturate these coils in melted grease or tallow, and give them a good thorough coating with as much black lead or plumbago (finely pulverized), as the material will absorb. It is a most superior article.

To Attach Glass or Metal Letters to Plate Glass.—Copal varnish, 15 parts; drying oil, 5 parts; turpentine, 3 parts; oil of turpentine, 2 parts; liquified glue, 5 parts. Melt in a water bath, and 10 parts of slacked lime.

Turner's Cement.—Bees' wax, 1 oz.; resin, ½ oz.; pitch, ½ oz.; melt, and stir in fine brick dust.

Bank Note Glue.—Dissolve 1 lb. of fine glue or gelatine in water; evaporate it till most of the water is expelled; add ½ lb. of brown sugar, and pour it into moulds.

Glazier's Diamond.—I have a glazier's diamond, which, after having lent to a friend, was returned completely spoilt, having been repeatedly drawn over the same line in his endeavours to cut glass. Can I repair this, or have it reset? The wedge-shaped cutting edge seems broken.

QUERIES.

[1008.] Can any of your readers supply a cheap and effectual remedy for sprains, bruises and rheumatism? Many quack medicines are advertised, but they are expensive when necessary to be used in quantity, and are seldom very effectual.

—Mechanic.

ANSWERS TO QUERIES.

[1006.] Take soap, and rub it well; then scrape some fine chalk and rub it also on the linen, lay it out on the snow, (or on the grass in summer) and as it dries, wet it occasionally, and the mildew will soon disappear.—E. E.W.

[1007.] You probably over feed your fowls with soft food, and if they are not kept in a very warm place, the cold retards their digestive organs, and in a very short time the food becomes putrid and the birds die. In such cases the only remedy is to open the crop with a pen knife, and with the end of a silver spoon remove the whole mass, sew up the incision carefully, and give a tea spoonful of castor oil and keep the bird on a very small quantity of food for a few days. The best food to fatten fowls with in winter, is Indian corn and small pieces of chopped meat, this should be given to them three times a day. They should be kept very warm and free from vermin, to remedy the last evil, keep your fowl-house frequently whitewashed, and sprinkle dry lime about the floor.

McBRIDE'S IMPROVED COUPLING FOR ROUND BELTS AND CORDS.

(See page 56.)

The rapidly extending use of round belts for transmitting power for various purposes, and the difficulty of making a reliable and permanent fastening between cord and coupling, has led to the above invention. The usual method of fastening is to chase a screw-thread in the coupling, and after screwing it on the cord to fasten it there with one or more rivets passing through the end of the cord and through the coupling. This soon gives way, and in the attempt to take out the rivets the coupling is so badly damaged as to be useless long before it is worn out.

The above invention consists in combining with the coupling as now made a gimlet-pointed wood-screw of the same pitch as the screw-threads in the coupling, and having its longitudinal axis concentric and parallel with that of the coupling, so that as the coupling is screwed upon the outside of the cord, the central screw shall penetrate the centre of the cord, thus forcing the fibres of the same out into the screw-threads of the coupling, besides so completely filling its own as to preclude the possibility of the coupling being pulled from the cord until it is worn out.

These couplings, we understand, are made and sold at about the same price as the ordinary coupling.

For further information, address James McBride, P. O. Box 90, Pittsburg, Pa.

CONGREGATIONAL CHURCH, BALLIOL ROAD, BOOTLE, NEAR LIVERPOOL.

(See Illustration in January Number.)

The church consists of nave (with short chancel appropriated to the organ), 100 ft. long and 41 ft. wide; two transepts, each 30 ft. by 13 ft.; deacon's vestry, ladies' vestry, and lavatories, and will accommodate 711 worshippers,—611 on the ground-floor and 100 in the gallery over the north entrance. The stone used is the local red sandstone; the tracery of windows out of Runcorn stone. The transept arches are carried on handsome granite shafts, the gift of a friend. Stourton stone finishings are freely used in the interior.

The roof of the church is panelled in pitch pine. The height from floor to apse is 50 ft. The hammer-beam and framing generally are boldly moulded. The benches and fittings are of pitch pine. The organ-screen inclosing the chancel, and the pulpit, are somewhat elaborate.—*London Builder.*

The deepest mine is not a mile below the surface, and we take the utmost extent that can be measured from the lowest opening known, to the highest mountain's peak, we shall not have more than the thousandth part of the distance from the surface to the centre. The skin of an apple is much thicker, in proportion than this geological crust.

ROTARY POWER PRINTING-PRESS.

(See page 56)

The printing-press illustrated herewith is named the "Pearl," but it must not be inferred that it is of "great price." On the contrary, the cost is so reasonable that it cannot be an objection to those fitting up printing-offices and aiming to be economical in their first outlay. Judging by what we observed in one of these presses in operation at the manufactory of the makers, Messrs. Golding and Co., 40 Washington Square, Boston, Mass., we have no hesitation whatever in stating that we consider it a press of beautiful design, compact in its mechanical arrangements, with ingenious and effective movements, and finished with a thoroughness and care that reflect the greatest credit on the manufacturers. Its mechanical construction and compactness may be judged somewhat by the accompanying engraving. It combines everything that can reasonably be expected in a printing-press, being made for hand-inking, self-inking, and self-delivering; for either hand, foot, or steam power; and at prices varying from twenty-five to two hundred and twenty-five dollars.

A very perfect movement to economize time in operating has been accomplished in the construction of this press. A period of rest is given to the platen to allow the workman to feed the sheets correctly for printing. The platen then starts gradually and closes quickly, dwelling on the impression a moment, which is necessary for good printing. It then opens quickly, wasting no time in its movements, which enables the operator to run the press very rapidly. The rotary power is obtained by means of a fly-wheel operated by a foot-treadle, giving a very steady and powerful motion. This improvement makes this press a very superior one for ease and rapidity of operation. With it the press may be run at the rate of 2,000 an hour, or it may be run as slowly as desired. It can be run at the rate of 3,000 an hour with a good workman to feed it.

The following good features are worthy of note:

The self-inking attachment, by which two inking-rollers are carried past the centre of the rotating ink-distributor and twice completely over the type before every impression, inks the type in a superior and thorough manner. The rollers are each independent of the other, and may be used separately if desired. Their pressure on the form is adjustable, and can be lessened or increased as desired. The rotating ink-disc rotates at each impression, thus giving a thorough and equal distribution of ink. One of the advantages of a rotating disc over a lateral moving plate, or cylinder, is that a rotating movement distributes the ink all around thoroughly and evenly over every portion, while a lateral movement feeds in only from the sides, giving a very light distribution in the centre and a heavy distribution at both ends. The impression is obtained by using a single or compound toggle-joint, according to the size of the press, which accumulates power immensely at the point of impression. The impression can be regulated as desired, for a full form or a single letter. The impression is regulated by four screws situated one in each corner of the platen. This is the only way by which a perfect impression can easily be obtained. The impression-screws have positive bearings, which are in view of the operator, and are provided with check-nuts to hold them firmly when set correctly, so there is no possibility of the platen slurring. The bed is finished perfectly true and smooth, and is placed in a perpendicular position, and remains stationary, so that the type rests upon it and cannot drop out; at the same time it is always in view of the operator. The bed in No. 3 size is supported by cross-ribs containing 132 square inches of iron, preventing any possibility of springing in the least. Other sizes are made in the same proportion. The platen swings on a rocker, and is balanced at every point in its movement, therefore requiring but very little power for its operation. This is one of its great advantages for hand or foot power. The register is perfect, as the platen has positive bearings, to which it is firmly held by a draught-screw. The chase is firmly secured to the bed by a strong and simple device, which is very quickly and easily adjusted. They are all squared and carefully fitted to each press. Each press is provided with a pair of gripping fingers, which are self-acting, holding the sheet in place, and removing it from the type as soon as the impression is made. They can be thrown down on the platen for adjustment, and can easily be removed for card-printing, where it is desired to have the cards drop. An adjustable bottom-gauge or guide for the paper is included with every press. It is easily changed to any position, and held firmly by a thumb-screw. The patent card-dropper is a new and simple device which removes cards from the type after receiving the impression, and opens the gauge, causing them to drop into a receiver below. By this arrangement 2,000 cards an hour can easily be printed. By means of the rocker, side-arms, which are continually in the way in feeding and delivering, and prevent sheets with large margins from being printed, are dispensed with. Its convenience for feeding and delivering is one reason why the press can be run rapidly. An inclined delivery-board is attached to every press. It is a great convenience for holding the printed sheets. One of its great merits is its ease of operation, adapting it especially to all offices where steam is not used, as it requires less power to operate it than any other press. The highest speed can be obtained, as it is only limited by the ability of the operator to supply the sheets in place to be printed, and this can be done quicker than on any other press. Each press will print a full form or a single line, in centre or out of centre, as desired, and for fineness of work they have no superior. There being no side-arms, sheets with large margins may be worked. Superior work can be done with this press, as the ink-distribution is thorough, the impression easily arranged, the register perfect, and every part made in a thorough manner. For beauty of design and finish "The Pearl" may be considered a "model of perfection." Every part of the machine that is not finished by machinery is enamelled, giving it a bright black, polished surface, almost as hard and durable as iron itself, rendering it proof against injury by acids, alkalies, or oils. Among the many advantages possessed by the Pearl Press should also be considered its adaptability to the increasing wants of a growing business. The Pearl Press can be changed into a self-inking, the self-inking Pearl Press into a rotary foot-power, and the rotary foot-power press to go by steam-power.—*American Artizan.*

G. BLUNCK'S PATENT PARALLEL RULE.

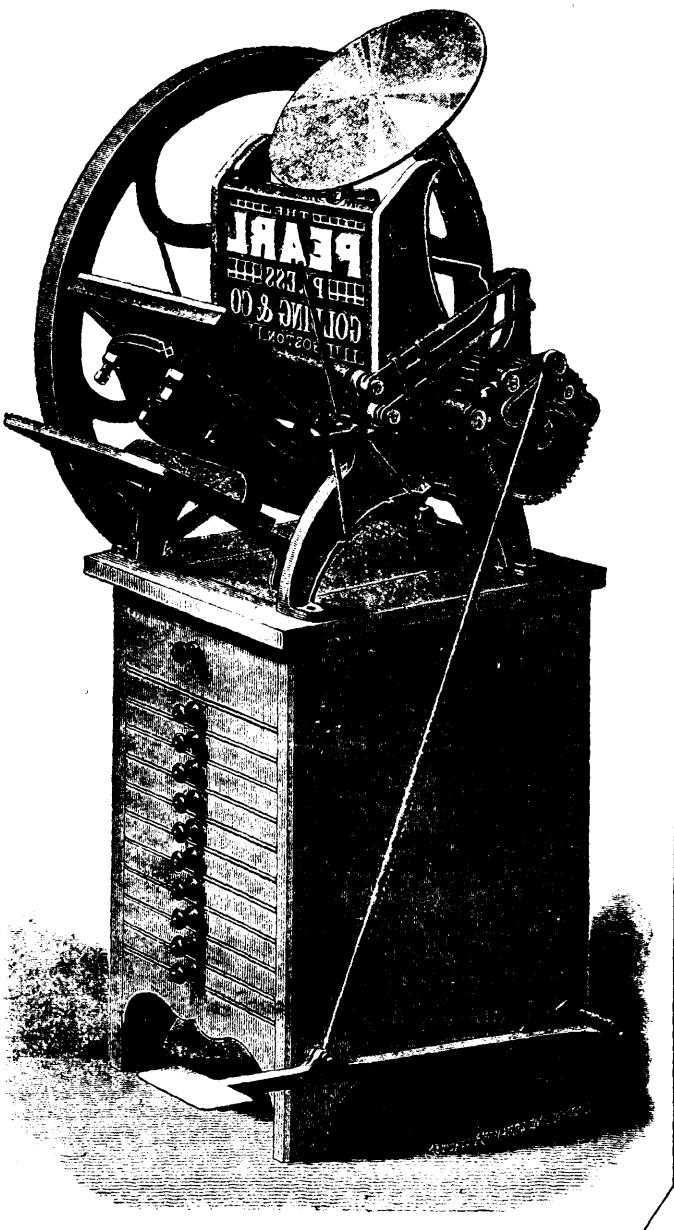
(See page 56.)

This instrument is designed to facilitate the hatching or shading of drawings by lines, as is required in most mechanical drawings; and also in drawings for engravers, surveyors, maps, etc., which tedious work requires, if done without proper instruments (which up to this time have been very expensive), great skill and steadiness of the hand and the eye to produce an elegant appearance. With the skilful use of this instrument, however, which any ordinarily skilful man may acquire with an hour's practice, absolute parallelism and equidistance of lines at any desired angle are produced, and a clean and elegantly-lined surface will be obtained.

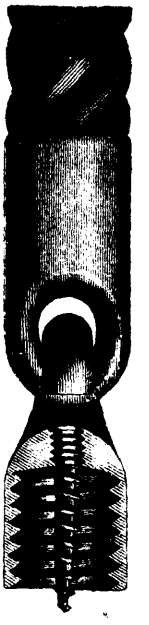
If the shading is intended to proceed from the left to the right hand, as is generally the case, the spiral spring on the right hand is unhooked, the two thumb-screws adjacent to the spiral springs are so adjusted that the desired distance of lines is produced, and the rubber straight-edge set to the required angle; the instrument is then ready for operation. It is set on the drawing, and the elliptic or band-spring, to which a wedge of hard rubber is attached, is pushed downward and released by the left hand. The pressure of the band-spring, when pressed downward, keeps the movable strip stationary on the paper, and the wedge pushes the box, and consequently the frame with the straight-edge, forward; as soon as the pressure on top of the spring is released, the spiral spring on the left hand side will pull the movable strip to the right hand as far as the thumb-screw on the left-hand side will allow. By continuing this operation, the whole instrument is caused to travel in one straight line across the drawing, making equal distance at each pressure on the top of the band-spring. Thus the operator, by drawing lines along the rubber straight-edge with the right hand, and alternately pushing and releasing the band-spring with the left hand, produces the desired shading. For moving in opposite direction, it is only necessary to unhook the spiral spring on the right-hand side, and connect the one on the left, and to readjust the thumb-screws.

The instrument, being of very small compass, may be used with the same readiness on small or large drawings, and without the aid of any other **T**-square or straight-edge. It was patented July 22, 1873.—*American Artizan.*

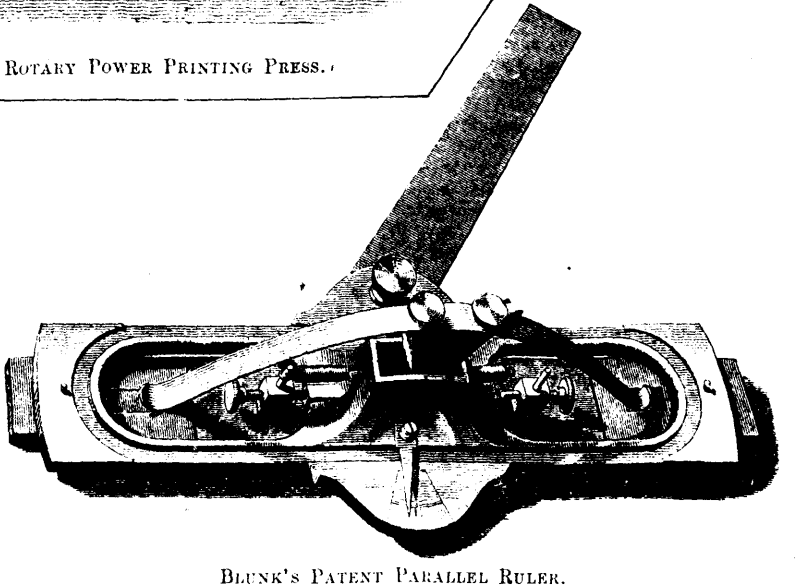
MR. E. SMITH of Bloomington, Ill., has patented a device which is thus described:—"It consists of a telescopic arrangement of tubes and a valve so arranged that when one tube is pushed within the other the valve is opened and steam admitted from the boiler whereby projectiles are thrown from the tube to drive cattle from the track." We would suggest as an improvement to this that a projecting spar be attached to the front of the locomotive with a torpedo at the end, which might be exploded under the beast by means of electricity in order to accelerate its movements. No patent applied for this improvement.



ROTARY POWER PRINTING PRESS.

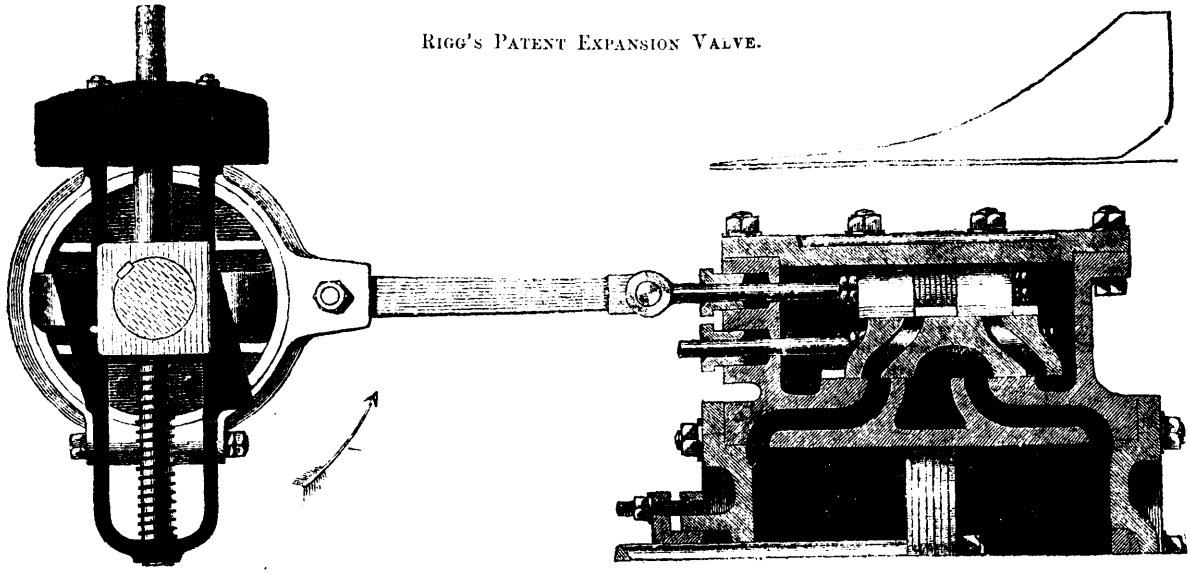


IMPROVED COUPLING FOR ROUND BELTS AND CORDS.



BLUNK'S PATENT PARALLEL RULER.

RIGG'S PATENT EXPANSION VALVE.



PREMIATED DESIGN FOR THE NEW CITY HALL, VICTORIA, B. C.

LECTURES TO LITTLE FOLK.

(See page 45.)

We trust that the toy, which was illustrated and described in the December Number of last year, and called a "Thaumatrope," has been made by many of our youthful readers, and found productive, not only of amusement, but made subservient to scientific information, and that they feel satisfied there is not only philosophy but literature in sport. We now exhibit on page 45, another toy, which, like the previous one, is indebted for its effect to the optical principle which we hope you now understand, viz.: that an impression made on the retina lasts for a certain period after the object itself has been withdrawn. The cuts A, and B., represent the instrument. It consists of a disk of blackened tin plate, which is made to revolve on its axis in the manner exhibited. A narrow opening or slit extends from the circumference to the centre as seen at A. If a device of any kind, as a star (which for increasing beauty of the experiment ought to be transparent and illuminated with a lamp), were to be placed behind the disk, it is evident that as long as the circles remain at rest, no other part of the figure can be visible than that which is immediately behind the slit A, but the instant it is put into rapid motion the whole of the star will be seen exhibited.

We must here explain that each successive portion of the figure seen through the opening remains in the eye until the circle has completed its entire revolution.

This experiment admits of a very curious modification, as follows:

Place three colored wafers at equal distances from each other, on the disk, and the instrument having been arranged before a looking glass, observe the reflected image as the circle revolves, and the wafers will appear blended into one continuous zone, upon the same principle that the ignited stick appears in a fiery circle when rapidly revolved. Now look through the slit in the disk as it revolves and see what new effect you observe. The three wafers will be seen very distinctly and perfectly at rest, although in rapid motion. The reason of this is that in viewing the image through the slit in the revolving disk, we catch but a momentary glance as it passes before the eye, and that the image thus produced on the retina, is retained until the next revolution again brings the slit into the same position. Now it is evident that, before the eye can ascertain a body to be in motion, it must observe it in two successive portions of time, in order to compare its change of place, but in the experiment under consideration, the glance is momentary, the wafer is no sooner seen than it passes away: its figure alone is impressed upon the retina, and this impression is continued without any change, until the circle completes its round, and consequently the image must appear at rest, thus the figure, but not the motion, of the wafer is discernible in the short period during which it is visible through the slit.

The following is another beautiful illustration of the same subject. A number of cogged wheels, cut of pasteboard set in motion in a perfectly dark room, when occasional flashes of light from an electric battery are displayed, their forms appear most distinctly, although whirling round at the time, they appeared to the spectator as motionless as so many solid blocks of marble. In like manner, in a storm during the darkness of midnight, the rolling ship and waves when rendered visible by flashes of lightning, will appear as completely at rest as a representative of them upon the canvas. So again, in viewing a fountain in full play, the eye sees only a clouded mist issuing from a jet; but, if in the dark we cause a succession of electric sparks to follow each other at short intervals of time, we shall at once perceive that this cloud consists of distinct drops of water. These successive drops, when seen in one continued light, follow each other so quickly, that the eye receives new impressions before the previous ones are extinguished, and hence a mass of confusion: whereas, in the instantaneous light which is shed by electricity, each impression stamps its image before the succeeding one can interfere with it, and a pause is afforded for the exercise of distinct sensation.

In our next number we will illustrate another toy, for your amusement on the same subject trusting that if *Philosophy in Sport* can be made *Science in Earnest*, our Lectures to Little Folk will relax the sternness of Science, by giving to it the aspect of Sport.

RIGG'S PATENT EXPANSION VALVE.

(See page 57.)

Modern improvements in engineering construction are no longer characterised by the startling innovations of former days, but are now mostly limited to re-arrangements of parts, or to apparently slight alterations, for the attainment of further economy in working. Of such a character is the variable automatic expansion valve which we this week illustrate, the invention of of Mr. Rigg, and adapted by Messrs. Wheatley, Kirk and Price to many of their large-sized engines.

It is, however, these apparently trivial, but in reality important inventions, which are nowadays sufficient to influence the balance of success to the enterprising firm who may energetically carry them out.

The economical working of steam-engines has for long been the subject of invention and gradual improvement. Much has been effected both in boilers and engines, so that the weight of coal required to be burnt per indicated horse-power is being gradually but steadily reduced. The variable automatic expansion valve is an excellent method for effecting further economy in the case of engines subjected to considerable variation in load.

An engine with a fixed rate of cut-off must, with full boiler pressure, be able to exert the maximum work required of it. If then, as is very often the case, the work to be done by such engine fluctuates, and falls much lower, the acceleration in speed which would inevitably ensue is usually checked by the closing of the throttle-valve, in the admission pipe, by the action of the governors. This throttling or wire-drawing of the steam causes it to be used at great economical disadvantage. The loss occasioned thereby may and often does—where the variation of load is very large—reach to as much as 50 or 100 per cent. of the whole work actually effected, or in other words, twice the amount of steam which would be actually necessary under the best conditions of expansive working, is being passed through the cylinder by throttling, to effect a given amount of work.

A variable automatic expansion valve, as its name supplies, is capable of varying the point of cut-off for admission of steam into the cylinder at any point of the stroke. This power of variation is communicated by some governing apparatus, either the ordinary governor balls, or some other suitable apparatus, which shall be influenced by a change in speed of the engine. The speed of the engine, under all variations of load, is thus kept practically constant by the earlier or later cut-off—by the expansion valve—of the admission of the steam into the cylinder. The steam is thus, under all circumstances, admitted at boiler pressure into the cylinder, and then truly expanding, extracts the maximum work out of the steam that is to be obtained. When the load is at its maximum, and the speed slightly decreased, the expansion valve will allow steam to be admitted at boiler pressure for the whole of the stroke, thus enabling the engine to develop the fullest power of which it is capable. To whatever extent also the work may decrease, the expansion valve causes the cut-off to be earlier and earlier, so that in all cases the steam is used in the most economical manner. The governor which we this week illustrate we had the opportunity of seeing exhibited,

fixed to a very fine 18-inch horizontal engine, at the Pomona Show, Manchester. This engine was a good specimen of a comparatively cheap and serviceable steam motor. Cheapness of detail and construction had been fully attended to where it did not interfere with efficiency. We understand that there are several variable expansion gears at work, and doing well, in different parts of the country and abroad. Two sister engines to the one exhibited, and fitted with Rigg's Governor, are driving the contractor's machinery on the site of the new Law Courts in the Strand.

The construction of this valve gear is very simple and is clearly shows in our illustration. The engine is fitted with the ordinary three-port slide valve, driven by separate eccentric tumblers and rods.

The eccentric tumbler of the expansion valve is free to work in a slot in a line with the throw of the tumbler, upon a square boss keyed to the shaft. The position of the tumbler in the line of its throw, is determined by two sliding inclined faces, moving in a direction perpendicular to the line of throw of the eccentric. These sliding inclined faces are part of a hoop forging, which embraces the square block keyed to the shaft, and has its extremities united by a heavy weight. This V hoop and weight form the governor. It is held in its normal position by a stiff spiral spring surrounding a strong pillar guide. Under any acceleration of speed, the weight tends to fly from the centre by centrifugal force, compressing the spring until the speed once more relaxes, and the spring resumes its normal condition. The effect of this sliding motion of the V hoop and inclined faces is to alter the throw of the expansion valve eccentric tumbler, and in this way to alter its point of cut-off much in the same way as by the hanging links of the locomotive.

In the one extreme abnormal position of the eccentric tumbler the expansion valve admits the steam for the full length of the stroke; in the other extreme position, the expansion valve will cut-off the steam supply almost altogether, by not allowing the steam ports to be open for any appreciable time. Only sufficient steam is then admitted to drive the engine unloaded.

We may, in conclusion, draw attention to the great simplicity and small number of parts in the whole governor gear and variable expansion arrangement. This is most valuable from the customer's point of view both for small cost and durability, and to meet the views of those most economically inclined, the governor gear can be attached to the eccentric tumbler of the single valve, with equal governing effect. The clean cut-off of the expansion arrangement is well shown in the accompanying indicator diagram.

These valves are supplied by Messrs. Wheatley, Kirk and Price, of Manchester. —*Iron.*

TO STRETCH DRAWING PAPER.

Lay the sheet flat on the board with that side undermost that is to be drawn upon, and with a sharp knife pare the thick edges from the paper; draw a wet sponge freely and rapidly over the upper side, beginning at the centre, damping the entire surface and allow the sheet to rest for a few minutes till all be damped through, and the surface water disappears. Those parts which appear to revive too soon retouch with the wet sponge, the damping should be done as lightly as possible and with little friction; now turn the sheet over and place it exactly in position on the board, and lay a straight edge or squares on the paper within ¼ of an inch of the edge of the paper, and fold back a margin upon it, smear over this margin with melted glue, the paper is then folded back on the board and the superfluous glue pressed out with a paper folder or other smooth article, the same operation being rapidly applied to the other edges the sheet is then left to dry.

PAPER FRICTION PULLEYS.—These superior mechanical contrivances are made by cutting pieces of pasteboard into a circular form, and of the desired diameter of the pulley, and placing them in layers one on the top of another, cementing properly with a good coat or glue between each layer, pounding or pressing them together as close as possible, and leaving a perforation in the centre of each, for the shaft. When you have got enough of these layers together to give you the proper breadth of pulley, allow the glue to harden, then turn it off to a smooth finish in a lathe. Secure each side of the pulley with a good stout iron flange large enough to cover the entire diameter, or nearly so, and with proper usage it will last a long time.

AID TO THE ART OF DRAWING.

(Continued.—See illustrations on page 24, January Number.)

THE PERSPECTIVE RULER.

Fig. 12 is a simple arrangement for drawing lines in correct perspective, and avoids the difficulties happening when a vanishing-point is marked at a considerable distance from the drawing, and the lines drawn therefrom by a long ruler. It consists in three arms of equal length pivoted together at one end by a screw-clamp. Two pins are inserted in the drawing-board against which two arms of the "perspective lineal," as it is termed, abut. The angle of these arms and the position of the pins are governed by the distance required for the vanishing-point, as the greater the angle, the further the same is removed, and *vice versa*. Once adjusted, the parts are clamped firmly together and the lines ruled by the upper side of the arm which rests upon the paper. Of course, the arms at an angle are always kept in contact with the pins, while the ruling arm, which is the lowest of the three, is moved up or down about the paper. This instrument is easily made of seasoned wood or metal. Two are necessary, right and left handed, owing to the construction, for use on each side of the board.

THE PANTAGRAPH.

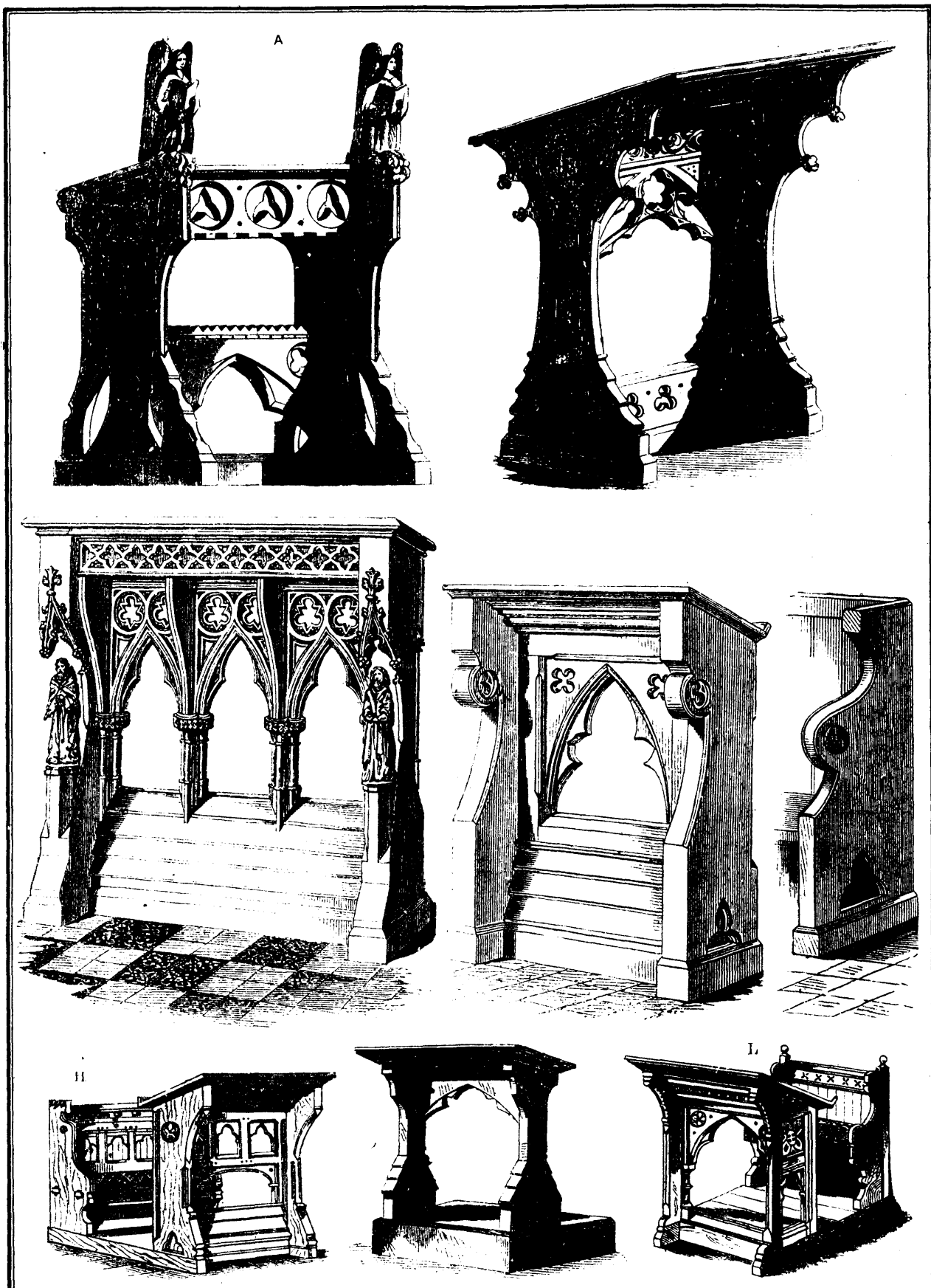
In concluding our series, we add an engraving of the pantagraph, Fig. 13, a quite useful instrument, in which the principle involved is that of the proportional compass. There are four rulers, jointed together at their intersections, and having at two of the angles, supports terminating in round points, or smoothly running casters. At one of the other angles is a weight to which the apparatus is pivoted, and which holds it in place, and at the fourth corner is a tracing-point, shown in the hand of the operator. Directly across the frame thus made, and pivoted at its ends to the centres of two of the bars, is a fifth ruler, through the middle of which passes a pencil. Along half the length of the two side-bars, and also of the central bar, are made perforations, so that the length of said rulers can be shortened as rendered necessary. The tracing-point is moved over the outline to be followed, and its motion is communicated to the series of rulers which by a kind of parallel movement actuates the pencil to describe precisely the same line, equal in dimension to that of the copy, or enlarged or reduced. Space forbids our entering into the mathematical demonstration of how this instrument reduces or enlarges, but generally it may be stated that the scales of the two drawings are to each other as the distances of the pencil and of the tracing-point from the fulcrum or pivot of the pantagraph, and these distances are adjusted by altering the position of the joints in the holes above noted. Any good mechanic can make the instrument for himself from hard wood, though metal is better. Care must be taken in constructing the joints, as looseness or bad fitting in such places greatly impairs the accuracy of the copy. In fact, any of the devices we have described require but little skill, though perhaps some time and patience in their manufacture. But if properly finished in a workmanlike manner, none will fail to be handy and useful additions to any apprentice's collection of drawing-tools.

IT is stated that a new line of British-built screw steamers will shortly begin running between Boston and New York and the west coast of South America by way of the Straits of Magellan.

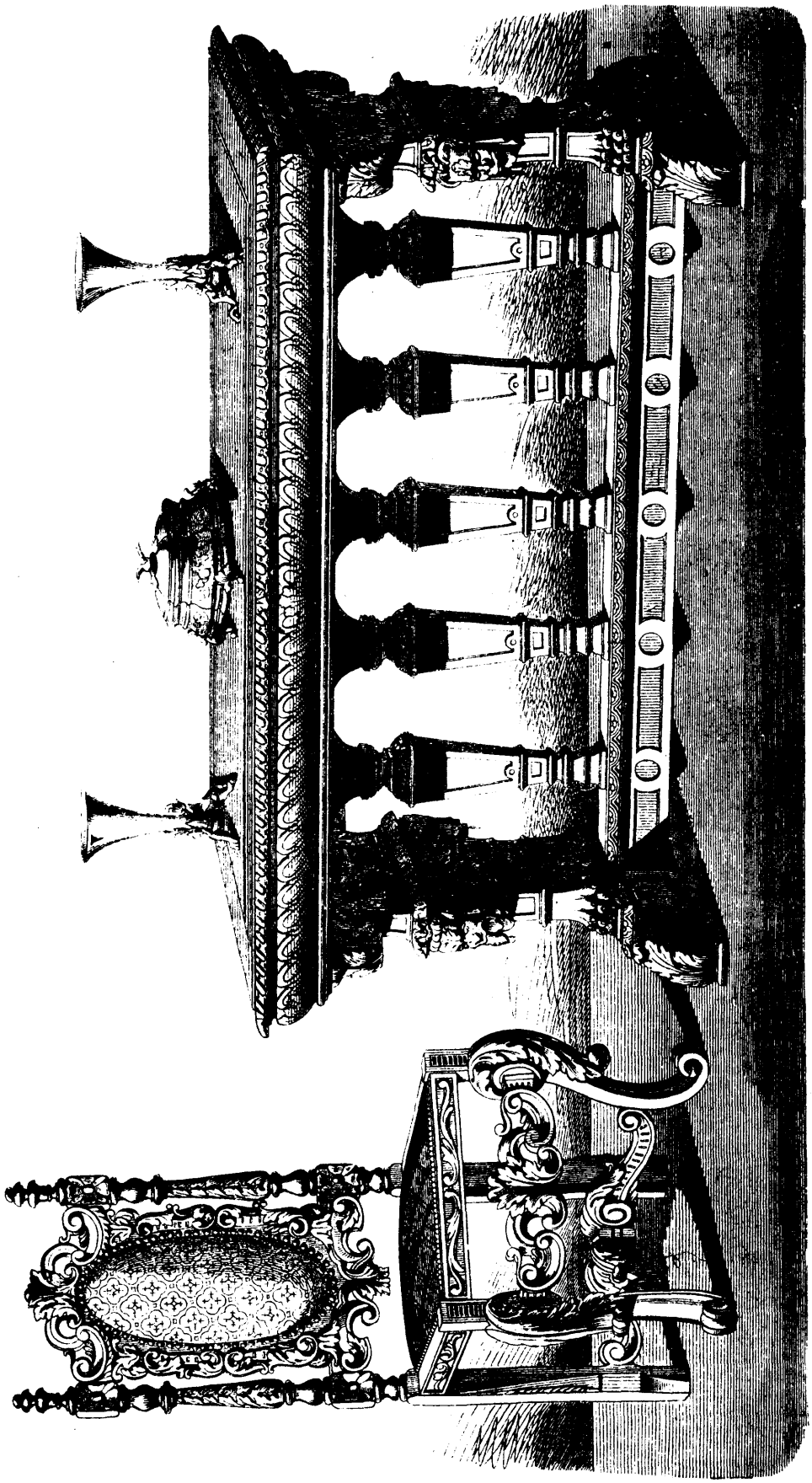
THE quickest miles of the recent trial trip of the postal train between New York and Chicago were 20, in which the time per mile ranged from 51 to 56 sec. The last 71 miles before reaching Elkhart was run in 71 minutes.

IN order to manufacture brown ochre, expose in a cast iron revolving retort, to a cherry-heat heat, a mixture of 110 parts yellow ochre with five parts of common salt for two hours. The product forms a brown ochre of unchangeable hue.

M. MOUCHON, a mathematical professor, has lately presented to the Academy of Sciences at Paris a curious apparatus, by which the solar heat may be so concentrated as to propel a small steam engine. It is by means of a reflector, having the form of an ordinary sunshade, inclined at an angle of 45 deg. on the axis, that M. Mouchon has succeeded in obtaining so curious a result. The heat of the sun penetrates through the sides of the vases which contain the water, and in eight minutes five pints of water may be caused to boil. M. Mouchon, in answer to some questions from the President of the Academy, gave the most satisfactory explanation, and convinced all present of the practicability of his invention,—which is Ericsson's.



EXAMPLES OF GOTHIC CHURCH FURNITURE.—READING DESKS.



FURNITURE EXHIBITED AT THE VIENNA EXHIBITION.
(A sideboard to match was illustrated in our last December number.)

DOMESTIC.

VARIOUS WAYS OF COOKING POTATOES.

The goodness of a potatoe materially depends upon the skill of the cook. We here introduce a few modes of preparing it for the table, not commonly in use.

POTATOES MASHED WITH ONIONS.—Prepare some boiled onions, by putting them through a sieve, and mix them with potatoes. Regulate the proportions according to taste.

POTATOE CHEESE CAKES.—1 lb. of mashed potatoes, 1-4 lb. of currants, 1-4 lb. of sugar and butter, and four eggs, to be well mixed together; bake them in patty pans, having first lined them with puff paste.

POTATOE COLCANON.—Boil potatoes, and greens, and spinach, separately; mash the potatoes; squeeze the greens dry; chop them quite fine, and mix them with the potatoes with a little butter, pepper and salt. Put into a mould, buttering it well first; let it stand in a hot oven for ten minutes.

POTATOES ROASTED UNDER MEAT.—Half boil large potatoes; drain the water; put them into an earthern dish, or small tin pan, under meat roasting before the fire; baste them with the dripping. Turn them to brown on all sides; send up in a separate dish.

POTATOE BALLS RAGOUT.—Add to a pound of potatoes a quarter of a pound of grated ham, or some sweet herbs, or chopped parsley, an onion or eschalot, salt, pepper, and a little grated nutmeg, and other spice, with the yolk of a couple of eggs; then dress as Potatoes Escolloped.

POTATOE SNOW.—Pick out the whitest potatoes, put them in cold water; when they begin to crack, strain, and put them in a clean stew-pan before the fire till they are quite dry, and fall to pieces; rub them through a wire sieve or the dish they are to be sent up in, and do not disturb them afterwards.

POTATOE SCONES.—Mash boiled potatoes till they are quite smooth, adding a little salt; then knead out with flour, or barley-meal to the thickness required; toast on a griddle, pricking them with a fork to prevent them blistering. When eaten with fresh or salt butter they are equal to crumpets—even superior and very nutritious.

POTATOES FRIED WHOLE.—When nearly boiled enough put them into a stew-pan with a bit of butter, or some clean beef drippings; shake them about often, to prevent burning, till they are brown and crisp; drain them from the fat. It will be an improvement if they are floured and dipped into the yolk of an egg, and then rolled in finely sifted bread crumbs.

POTATOES ESCOLLOPED.—Mash potatoes in the usual way; than butter some nice clean scolloped shells, patty pans, or teacups or saucers; put in your potatoes; make them smooth at the top; cross a knife over them; sprinkle them with a paste brush with a few drops of melted butter, and set them in a Dutch oven. When nicely browned on the top, take them carefully out of the shells, and brown on the other side. Cold potatoes may be warmed up this way.

POTATOES FRIED IN SLICES.—Peel large potatoes, slice them about a quarter of an inch thick, or cut them into shavings, as you would peel a lemon; dry them well in a clean cloth, and fry them in lard or dripping. Take care that the fat and frying-pan are quite clean; put it on a quick fire, and as soon as the lard boils, and is still, put in the slices of potatoe, and keep moving them until they are crisp; take them up and lay them to drain on a sieve. Send to table with a little salt sprinkled over them.

POTATOE PIE.—Peel and slice your potatoes very thin into a pie-dish; between each layer of potatoes put a little chopped onion; between each layer sprinkle a little pepper and salt; put in a little water, and cut about two ounces of fresh butter into bits, and lay them on the top; cover it close with paste. The yolks of four eggs may be added; and when baked a table-spoonful of good mushroom ketchup poured in through a funnel.—Another method is to put between the layers small bits of mutton, beef, or pork. In Cornwall, turnips are added. This constitutes (on the Cornish method) a cheap and satisfactory dish for families.

TREASURES.

PRACTICE without knowledge is blind, and knowledge without practice is lame.

THE ear and eye are the mind's receivers; but the tongue is only busied in expending the treasure received.

I HAVE ever observed the humblest men most tender of making separations, and the proudest men most prone to it.

THAT man only is truly brave, who fears nothing so much as committing a mean action, and undauntedly fulfills his duty, whatever be the dangers which impede his way.

IT is not pleasure which corrupts men, but men who corrupt pleasure. Pleasure is good in itself. It is the seasoning which God, the all-wise and the all-good, gives to useful things and needful acts, in order that we may seek them.

CHARITY is a virtue of all times, and all places. It is not so much an independent grace in itself, as an energy which gives the last and highest finish to every other, and resolves them all into one common principle.

THE man who can pray truly, though languishing in extremest indigence, is richer than all beside; whilst the wretch who never bowed the knee, though proudly seated as a monarch of nations, is, of all men, most destitute.

BISHOP BUTLER remarks, that it is one of the weaknesses of our nature, when, upon a comparison of two things, one is found to be of greater importance than the other, to think this other of scarce any importance at all.

THE Holy Scriptures are a rich, overflowing fountain, which, the deeper you dig, the more you find it abound with water: in like manner, the more you search the sacred volume, the fuller, you will find, are the veins of living water.

IT is in the minute circumstances of a man's conduct that we are to inquire for his real character. In these he is under the influence of his natural disposition, and acts from himself; while in his more open and important actions he may be drawn by public opinion, and many other external motives, from that bias which his disposition would have taken.

THAT courage which prompts us to court death is but the courage of a moment, and is often excited by the vain hope of posthumous fame. There is a species of courage more necessary, and more rare, which makes us support, without witness and without applause, the various vexations of life, and that is Patience. Leaning, not upon the opinions of others, but upon the will of God, patience is the courage of virtue.

WHO can tell the value of a smile? It costs the giver nothing, but is beyond price to the erring and relenting, the sad and cheerless the lost and forsaken. It disarms malice, subdues temper, turns hatred to love, revenge to kindness, and paves the darkest paths with gems of sunlight. A smile on the brow betrays a kind heart, a pleasant friend, an affectionate brother, a dutiful son, a happy husband. It adds a charm to beauty, it decorates the face of the deformed, and makes a lovely woman resemble an angel in paradise.

TRIFLES.

WHEN it rains *hardest*, people catch most *soft* water.

A WAG once remarked that the reason why unmarried ladies looked so often at the moon was the vulgar belief that there was *a man in it.*

A YOUNG man stepped into a book store, and said he wanted to get a "Young Man's Companion." "Well, sir," said the bookseller, "here's my daughter!"

A SHORT man became attached to a *tall* woman, and somebody said that he had fallen in love with her. "Do you call it *falling* in love?" said the suitor; "it's more like *climbing up to it.*"

MR. HUNT, in his lecture on common law, remarked, "that a lady when she married lost her personal identity—her distinctive character; and was like a dew-drop swallowed by a sun-beam."

AN awkward man, attempting to carve a goose, dropped it on the floor. "There, now!" exclaimed his wife, "we've lost our dinner." "Oh, no, my dear," answered he, "it's safe, *I have got my foot on it!*"

A LOVER gazed in the eyes of his mistress until she blushed. He pressed her hand to his heart and said, "My looks have planted roses on thy cheeks: he who sows the seed should reap the harvest."

A GENTLEMAN wishing to get rid of a visitor, and not liking to tell him—"There's the door," modified it thus:—"Elevate your golgotha to the summit of your pericranium, and allow me to present to your ocular demonstration that scientific piece of mechanism which forms the egress portion of this apartment!"

A BOY, selling newspapers at the railway station at Ely, was calling out one Saturday evening,—"To-day's *Times*, gentlemen," upon which a passenger, attempting a witticism, cried out, "What's the use of *to-day's Times*? I'll give you a shilling for *to-morrow's*!" and the boy immediately handed him the *Sunday Times!* when the passenger refused to give him more than sixpence, but his fellow-travellers made him keep his word, and give the sharp-witted boy a shilling for a sixpenny paper.

"DECLINED WITH THANKS."

How hard when we for print have penn'd
Some poem, article, or pun,
To find our labours all must end
Exactly where they were begun;
Save that they show amid the ranks
Where failures are "Declined, with thanks."

Think of this, ladies; for with you
(Though editorial thrones you lack)
Lie an unbounded power, too:—
You keep our hearts, or send them back;
You *prize* them, or you make them *blanks;*
Then think ere *you* "decline, with thanks."

QUIP.

A NEW PIN is exhibited, which promises to become quite popular for many purposes, on account of the impossibility of its working out of the fabric in which it is placed. It is made of a piece of ordinary wire sharpened at both ends. One extremity is then turned down and wound spirally for a couple of turns about the shank. When the pin is inserted, a slight twist given to the bent end causes the sharp point of the spiral to catch and enter in the cloth. The inventor has not only devised the pin, but some very ingenious machinery for its manufacture. One apparatus cuts off the wire, sharpens the ends, and throws the piece into a hopper, whence it passes into another machine which produces the spiral. The rate of production of the pins is about 200 per minute. Mr. R. W. Huston, of Brooklyn, New York, is the inventor.

RECIPES FOR MAKING BUCKWHEAT CAKES.

One quart of buckwheat flour, a small teacupful of Indian meal, one and a half teaspoonful salt, four tablespoonfuls good lively yeast; mix with milk and tepid water enough to make it the consistency of muffin batter; then beat well for fifteen minutes, and set in a warm place to raise over night. In the morning the batter may be sour; if so, dissolve a teaspoonful of soda in a little warm water and stir in; if the cakes are not sweet add more saleratus; do not beat the batter; add a tablespoonful of molasses to brown the cakes—the milk does not always brown them sufficiently. Bake on a well heated griddle that is perfectly clean; a soapstone griddle needs no greasing; an iron griddle should be greased with a piece of rind of ham or fat salt pork on a fork. Butter and silver-drips syrup are best to eat with buckwheat cakes; maple syrup is also good.

ANOTHER—Let the buckwheat be of the hulled sort, and fresh. Put into a two-quart pitcher one and a half pints of tepid water; add four tablespoonfuls of baker's or as much "compressed" yeast as will make one loaf of bread—other kinds in proportion—with a little salt. Then stir in buckwheat enough to make a thick batter; cover the pitcher and set away to rise over night, after beating thoroughly. In the morning add three tablespoons of molasses, and a quarter of a tablespoonful of soda, dissolved in about three tablespoons of milk. Beat all well together, and pour the cakes from a pitcher upon a well heated griddle.

STILL ANOTHER.—Take one cupful of flour, two of buckwheat flour, and one of yeast; one tablespoonful of sugar, and salt according to taste. Mix with enough water to make a stiff batter, and set to rise over night. In the morning add water in sufficient quantity to make the batter run when poured on the griddle.

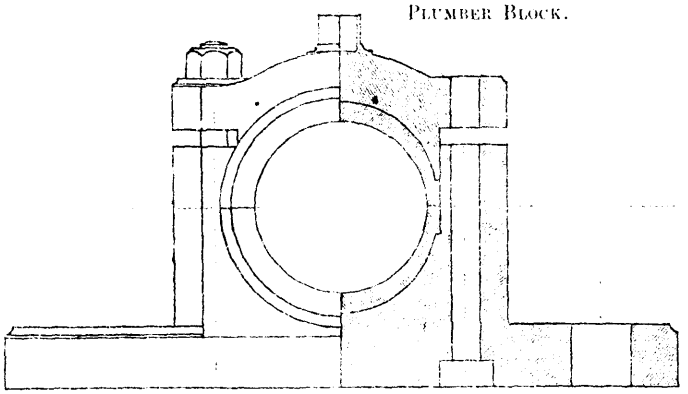
HINTS FOR WIVES.—Don't imagine when you have obtained a husband that your attention to personal neatness and deportment may be relaxed. Now, in reality, is the time for you to exhibit superior taste and excellence in the cultivation of your address, and the becoming elegance of your appearance. If it required some little care to foster the admiration of a lover—how much more is requisite to keep yourself lovely in the eyes of him to whom there is now no privacy or disguise—your hourly companion. And if it was due to your lover that you should always present to him, who *proposed* to wed and cherish you, a neat and lady-like aspect; how much more is he entitled to a similar mark of respect, who has *kept his promise with honourable fidelity!* and linked all his hopes of future happiness with yours. If you can manage these matters without appearing to study them, so much the better. Some husbands are impatient of the routine of the toilet, and not unreasonably so—they possess active and energetic spirits, sorely disturbed by any waste of time. Some wives have discovered an admirable facility in dealing with this difficulty; and it is a secret which, having been discovered by some, may be known to all—and is well worth finding out.—*Family Friend.*

POISONED DYES.

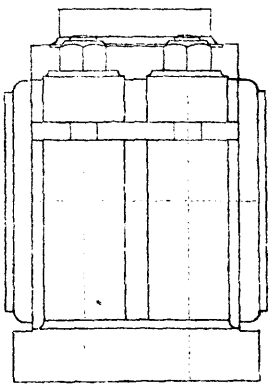
The *Pall Mall Gazette* calls attention to this subject in the following way: "Adulteration is bad, but poisoning is worse, especially poisoning by arsenic. The agonies which are endured by those who have swallowed or imbibed arsenic in poisonous quantities are too well known to need mention, and arsenic applied in the shape of dye for materials, whether silk or woollen, which are worn next the skin, brings about consequences nearly as dangerous and as painful. Attention should be called to the subject, because it seems that manufacturers are recommencing the use of this substance for dyeing articles of personal apparel. That arsenic (in the shape of Scheele's green) has long been used to produce the well-known dazzling green in dresses, artificial flowers, and papers for walls, and that these articles have produced all the effects of arsenical poisoning, are facts so well established that sensible people have contented themselves with avoiding any material of that particular color; but lately Dr. Sedgwick wrote to the *Times*, stating that his wife and himself having 'suffered much in the manner that people do when poisoned by arsenical vapors,' he analyzed his bedroom paper, which was pale blue, and found a large quantity of arsenic. Now blue wall-papers are generally thought safe. Some years ago silk socks and stockings dyed in stripes of very brilliant hues—orange, purple, and crimson—were sold; and many persons suffered frightfully through wearing them. The first symptoms were intense irritation in the skin of the feet, swelling, and an inflamed appearance; then an outbreak of watery blisters of all sizes, from groups of the size of hempseed to single blisters on the sole of the foot larger than a five-shilling piece. This condition was accompanied by general feverishness, rigors, loss of appetite, and a sensation of pervading malaise. In a severe attack the patient was rarely able to walk for three weeks, and after one attack passed off it was often followed by another of a milder type. In one case a gentleman was obliged to wear cloth shoes for upwards of eight months, and with other patients the system has been so impregnated with the poison that blisters have reappeared at intervals, not only on the feet, but on the hands, ears, etc., for more than three years. There was no doubt as to the cause and method of this blood-poisoning, for the blisters first came in stripes corresponding to the colored stripes of the stockings, and the laundresses complained of the irritation and inflamed condition of their hands after washing these poisonous articles. In another instance a crimson silk vest dyed in the same way was worn for two days with consequences very painful to the wearer. A Scotch lady brought a successful action against the firm which had supplied her with these goods; the manufacturers had a "scare," and it was formally announced that the employment of arsenic for dyeing wearing apparel would be abandoned. But that this abominable practice has been recommenced seems tolerably certain. And a recent case is mentioned, too, of a person who had a serious attack of blisters on his forehead, caused by a poisonous dye used for the lining material of his hat. The head is the most perilous point of attack, for this particular form of blood-poisoning, though it is not erysipelas, has a strong tendency to run into that painful, disfiguring, and dangerous disease."

SMELLING SALTS.—Some time ago I used to make smelling salts by mixing sal-ammoniac and quicklime together, and then resubliming.

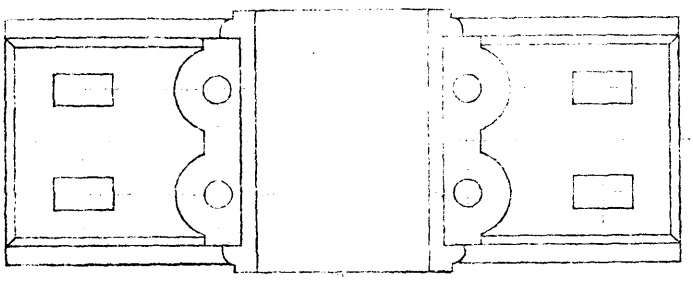
PLUMBER BLOCK.



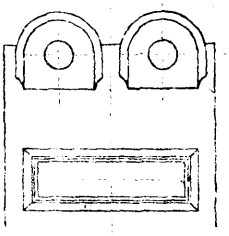
FRONT ELEVATION.—HALF SECTION.



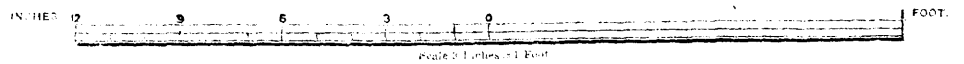
END ELEVATION.

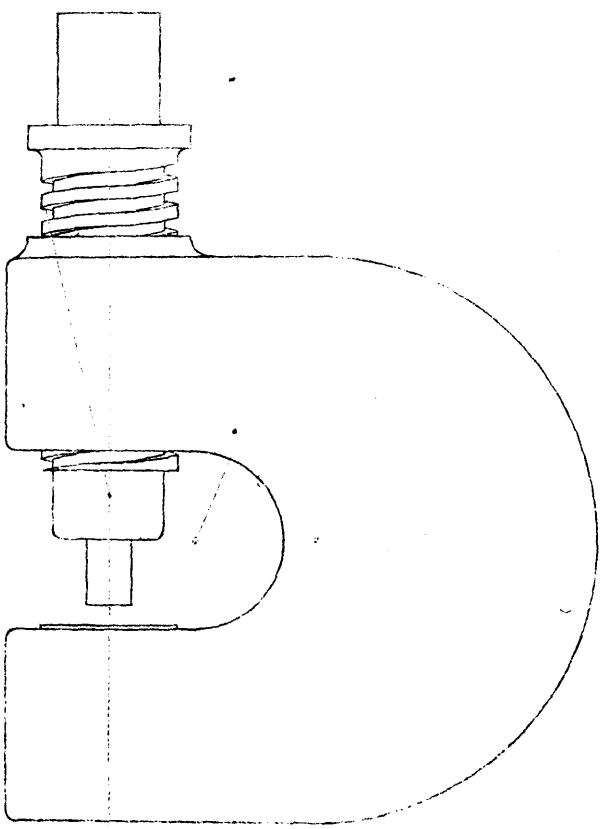


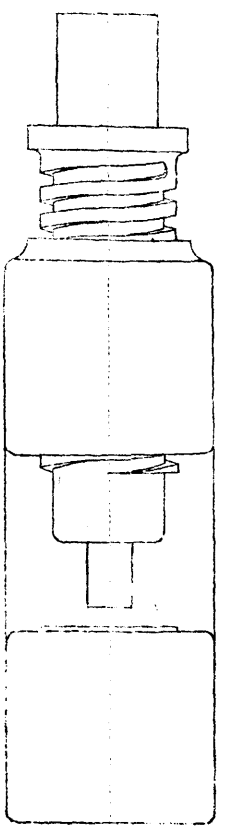
PLAN WITH CAP REMOVED.



HALF PLAN OF CAP.







BOILER BEAR.—HALF SIZE.

MECHANICAL DRAWING.