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THE LONDON TIMES ON AMERICAN EXHIBITORS.

On another page will be found an article from the London *Times* on the American department of the great Exhibition, which closes with the remark,—"Taking the American exhibition as a whole, there is no department in which the exhibitors will reap more profit from their pains, and perhaps this is as high praise as we can pass upon it."

Considering that the *Times* is an habitual slanderer of this country, and considering the other circumstances of the case, we regard this as very high praise. It is gratifying to us less as a tribute to the skill of our countrymen, than as a testimony to one of the many beneficent operations of republican institutions.

The *Times* says that our exhibitors will reap profit for their pains. This means that our manufacturers, by displaying their wares, are to find a sale for them in Europe. Now, there is only one way in which our manufacturers can compete with those of Europe in European markets; and that is by conducting their operations with superior intelligence and skill. All other advantages are on the side of the European manufacturer; his capital is cheaper, his labor is cheaper, and the market is at his own door. But all of these great and usually-controlling advantages have been repeatedly overcome by the greater intelligence with which the American manufacturer has prosecuted his business.

This superiority has generally been shown in the larger use of labor-saving machinery—substituting the great forces of nature for the feebler power of human muscles. The introduction and use of this machinery has been materially facilitated by the superior intelligence of our mechanics and laborers. The spinning jenny, the steam engine, and nearly all of the great labor-saving machines that have been invented and introduced in England, have been at first broken in pieces by mobs of workmen under the foolish apprehension that they would cause a reduction of wages. But our mechanics, so far from objecting to the use of labor-saving machinery, keep their minds constantly on the stretch to devise improvements in mechanism by which still greater saving of labor will be effected.

This constant effort of the great mass of the community to facilitate still further the operations of industry is doubtless to a great extent due to our liberal patent system, with low fees, but it also results, in no small degree, from that "many-sided culture" that Grote dwells upon as the most destinctive characteristic of the ancient democracy of Athens, and that has characterized every democratic community of which history has preserved the record.

This many-sided culture is seen to a larger extent in England than most of the countries of continental Europe, because of the large democratic element in the English constitution, and it has been more fully developed in this country than ever before in the history of mankind, because here democratic institutions have received their fullest development. It is a different thing from the study of books, though it is aided by early school education to an extent than no one can fully appreciate. It has been immeasurably advanced by those public schools which were established by the middle class of Englishmen who settled our Northern States, and who would long since have established similar schools in the mother country, had it not been for the instinctive jealousy of that privileged nobility and hierarchy of which the London *Times* is now the champion.

FORGING—STEAM AND TILT HAMMERS.

All the branches of engineering are mutually dependent upon one another. This age is particularly distinguished in the construction of gigantic engines. Some of these great motors exert a power equal to three thousand horses. The construction of their different parts involves a vast range of inventive genius and the employment of a great variety of machines. It is an undeniable fact that mechanical engineering has attained to its present dimensions and perfection through improved tools, such as lathes, planers, slotting machines, steam hammers, &c. Such tools are required to form the several parts of self-acting motors; and, again, these tools are driven by these motors, hence their mutual dependency. A steam hammer may be called a tool on account of its office although it is really a peculiar steam engine. Its office is to forge masses of iron and steel and form them into important parts of machines. Without the application of the mighty power of steam in this direction, we could not obtain those huge shafts, cranks and beams required in the construction of the great engines which are now fabricated. The steam hammer is one of those useful inventions by which progress and improvement have been made in all branches of the mechanical arts to which it has been applied. It has effected a great saving in the several kinds of manual labor, and it may be guided to forge a needle or a shaft of many tuns weight.

The chief merits of modern engines depend, perhaps, principally upon the forged work used in their different parts. Formerly shafts, beams and the framing of marine and other engines, were mostly made of cast iron; now, however, they are made of wrought iron. Increased strength and greater durability have been secured by the change. Much, however, in the character of forged work depends upon the skill of the operator. The steam hammer can only strike the blow, the operator must guide it.

With respect to the principles of operating steam hammers, J. W. Nystrom, C. E., in his "Hand-book of Engineering," states that a heavy hammer, with a short fall, produces a better forging than a light hammer with a high fall. "This is accounted for," he says, "by the inertia of the ingot forged. The effect of the blows of a heavy hammer and short fall will penetrate through the metal, and nearly with the same effect on the anvil side, while a light hammer and a high fall will effect the metal on or near the surface of the blow." In guiding the force of the hammer to produce good forging, he also gives directions which should be followed by all blacksmiths. He states that in forging a large shaft it is generally piled up with iron bars, and when placed under the hammer at a welding heat, very light and gentle blows are first given for which a light hammer may be used, but afterward a heavy hammer, to squeeze the whole mass together in order to produce a sound welding.

He says respecting imperfect forgings:—"I have often seen, in broken shafts, the bars in the center as clean and unwelded as when first piled, which is a sure indication that the shaft had been forged by a hammer that was too light."

One great object in forging should be to secure the exact size and form of the article—rod, crank or whatever it may be—as near as possible, so that very little work will be necessary, afterward, in turning or planing to fit it into its appropriate place. Another reason for being careful in obtaining perfect forgings, is to obviate the removal of much of the surface of forged metal by planing or grinding afterward, because the interior of large forging is generally not so strong as the portions near the surface. It has frequently occurred that large crank shafts forged under a light steam hammer, have had the very best parts of the metal removed by planing and turning in the machine shop. This advice is also applicable to large castings. These should be as perfect in form as possible when removed from the molds, because the metal at the surface is generally stronger than in the interior. Shafts that are judiciously forged under a heavy hammer are generally more uniform in strength than those forged under a light hammer.

The oldest form of those large hammers which superseded manual power, is the tilt hammer, which was first driven by a cam roller secured on the shaft of a water wheel. Its action otherwise is exactly similar to a sledge hammer, and it is still in common use, operated either by steam or water power in almost every machine shop. The weight of such hammers ranges from 50 lbs. to 400 lbs., according to the purposes for which they are employed. For forging nail rods a hammer of 50 lbs. is used; for forging blooms of 60 and 100 lbs. in weight, hammers of 300 and 400 lbs. are employed. Iron and steel helves do not stand the vibrations so well as wooden helves. In operating tilt hammers they are usually thrown up by striking down upon the butt ends of their helves. This action makes them vibrate upon their fulcrum pins. The power of the blow, according to Overman, increases with the ratio of the weight and according to the square of the speed. "If the hammer," he says, "strikes with 100-lb force when seventy strokes per minute are made, it will, when 140 strokes per minute are made, strike with a force of 400 lbs. The same rule is applicable in relation to the space described by the hammer. If the hammer, lifted 10 inches, strikes with a force of 1,000 lbs., it will, when lifted 20 inches, strike with a force of 4,000 lbs." In operating such hammers, therefore, a double speed requires four times the steam or water power.

In the London International Exhibition are shown some immense iron forgings, one piece from the works of a Liverpool firm weighing over 24 tuns. The same party exhibit a forged armor plate 21 feet 3 inches long, 6 feet 3 inches wide, and 5¼ inches thick, having a superficies of 133 feet and weighing upward of 13 tuns. But in mammoth steel forgings the Germans bear away the palm. The celebrated Herr Krupp exhibits an ingot *broken*, each fragment weighing 10½ tuns. It is 44 inches in diameter, and when whole was 8 feet long. About one-fourth of the section was cut away to enable it to be severed and then it required 150 blows of a 50-tun hammer fully ten feet to break it.

In another article we shall present information respecting the history and different kind of steam hammers.

GINNING SEA-ISLAND COTTON IN BROOKLYN.

When the Union forces, last fall, took possession of the islands on the coasts of South Carolina, Georgia and Florida, the planters fled, leaving large quantities of unginned cotton behind them. Much of this cotton was collected and sent to New York, consigned to collector Barney, to be sold as confiscated property. Knowing that it would bring very low prices, and that it was unfit for shipment abroad in its unginned condition, he took measures to have it cleaned to prepare it for sale. For this purpose a contract was made with Mr. F. H. Lummus, of Williamsburgh, L. I., assignee of the patent of Brown's Excelsior Gin—Patented March 23, 1858, and described on page 235, Vol. XIII. SCIENTIFIC AMERICAN (old series). When this contract was made there was only one of these gins in this city, but measures were at once taken for the construction of several, a large brick building as a gin house was leased, in King street, near the Atlantic Docks, South Brooklyn, and here there are now eighteen of these gins running constantly, and four more will soon be added to the establishment. Sea-island cotton is distinguished for its long and silky fiber, but in its unclean condition it is a useless-looking substance, resembling knots of wool, each with a hard black seed in its center, to which the cotton adheres as sheep's wool to a burr. The ginning operation consists in removing the cotton from the seed. Whitney's famous saw gin cannot be used for cleaning this staple of it, because it would injure the long fiber. The old sea-island cotton gin consists of two long wooden rollers set closely together. The cotton was fed against the rollers, the fiber was drawn between them, and the seeds were prevented from passing through, and thus this cotton was formerly cleaned.

The McCarty single-roller gin was a great improvement over the old double-roller gin; Brown's gin consists of a single roller, a steel breastplate, and a vibrating stripper by which the seeds are thrown down behind and through a grating, while the cleaned cotton is delivered in front. To present some idea of its construction and operation, we will state that it almost resembles a box about three feet in hight, three feet in width and the same in length. In front and on the top is a leather covered wooden roller, about five inches in diameter, and 36 inches in length. The leather with which it is covered is formed of strips two inches in width, wrapped spirally around it, tacked down at the edges, and beveled so as to form a spiral groove from end to end. Behind this roller is a steel breast plate, almost resembling a broad and long shaving knife. It is of exquisite and peculiar temper, and made by Henry Diston, of Philadelphia. The edge of this plate presses close against the back of the roller, and above it extending across is a vibrating or stripping bar, which plays up and down like the crosshead of a saw gate. Behind this is the feed board which has an iron grating situated close to the breast plate. The uncleaned cotton is placed on the feed board, and is pressed forward in a stratum by the girl that attends the gin. The machine is driven by band and pulley, the roller rotates downward toward the steel breastplate, and draws the fiber of the cotton between the roller and the steel plate. There is not sufficient space for the seed to pass through between the roller and the breastplate scraper; therefore the seed is left behind, and the vibrating stripper strikes down upon it, executing a series of small blows which knock off the seed, driving it through the grating, and into a receptacle below the feed board. The uncleaned cotton goes into the gin behind a mass of black and white knots; it comes out in front, a beautiful white silky looking fiber. A cord is stretched in front from side to side across the roller, to prevent the cotton from being carried around and clogging the gin. When a gin is first started, the ginned cotton drops from the roller freely, but after running for a short period, the roller becomes so positively charged with electricity, that the cotton is attracted to it, and would be carried round and round but for the stripping cord in front. One of these gins will clean from 200 to 250 lbs. of cotton per day, in a superior manner, but it can also be run to clean 500 lbs. Cotton requires to be very dry for ginning freely. During rainy weather, and when the atmosphere is charged with moisture, the ginning proceeds very slowly. In dry clear days the cotton is spread upon the roofs of extension buildings attached to the main building, for the purpose of removing all the moisture from it. The top story is also employed as a drying room during wet weather. An engine of 30-horse power is placed in an adjacent low building for driving the gins, which are situated on the second floor, and the ginned cotton drops through openings to the first floor, where it is taken and placed in long bags. The baling of this cotton is a rather curious operation. Round holes are cut in this floor opening into the basement. Bags are placed in these holes, and suspended in them with their mouths wide open, and lips fastened to the floor. Two active "contrabands," in Government service, and who were accustomed to this business in Dixie, do the baling. They place armful after armful of ginned cotton in these bags, get into them and tread it down with their feet, and also pound it with an iron bar, and thus they pack in layer upon layer until a bag is filled. This is severe labor, and it seemed to us that it could be performed by machinery, but we were informed that although short staple cotton may be pressed in a machine and sent in safety to Europe, sea island cotton when pressed in bales and sent abroad loses all its strength of fiber before it reaches England. This can only be accounted for by *eremacausis* taking place in the cotton when so packed. Why should this be so is an important inquiry. We believe that this cotton may be packed in a press, and any required degree of pressure given, so that it may be as safely carried to Europe, as when packed by manual labor. As a telling fact in favor of free labor, we were informed, that any one of the girls attending these gins could do as much work in one day as three slaves. Here each of the two colored cotton packers packs six bales per day, under the stimulant of freedom, while in the South three bales per day was held to be a good day's work.

The ginned and baled cotton is taken from this house to the Government storehouses, and when a sufficient quantity is ready for sale, it is advertised and sold at auction. About five million pounds of Government cotton have arrived at the Atlantic Docks, Brooklyn; about two million pounds of which have been ginned and sold. More is expected to arrive shortly, and especially some of what is called "Coffin Cotton," a species cultivated on Col. Coffin's plantations at Beaufort, S. C., and which is stated to be the largest and most beautiful staple that comes to market. Almost all the sea island cotton that is raised, is bought for English spinners to be spun into thread and yarn for making lace, lawn gauze and fine muslins.

Extracts from Agassiz.

From the article by Agassiz, on "Methods of Study in Natural History," in the July number of the *Atlantic Monthly*, we take the following extracts:—

I have spoken of the plans that lie at the foundation of all the variety of the animal kingdom as so many structural ideas which must have had an intellectual existence in the Creative Conception independently of any special material expression of them. Difficult though it be to present these plans as pure abstract formulæ, distinct from the animals that represent them; I would nevertheless attempt to do it, in order to show how the countless forms of animal life have been generalized into the few grand but simple intellectual conceptions on which all the past populations of the earth as well as the present creation are founded. . . . . . .

There is nothing more striking in these early populations of the earth than the richness of the types. It would seem as if, before the world was prepared for the manifold existences that find their home here now, when organic life was limited by the absence of many of the present physical conditions, the whole wealth of the Creative Thought lavished itself upon the forms already introduced upon the globe. After thirty years' study of the fossil crinoids, I am every day astonished by some new evidence of the ingenuity, the invention, the skill, if I may so speak, shown in varying this single pattern of animal life. When one has become, by long study of Nature, in some sense intimate with the animal creation, it is impossible not to recognize in it the immediate action of thought, and even to specialize the intellectual faculties it reveals. It speaks of an infinite power of combination and analysis, of reminiscence and prophecy, of that which has been in eternal harmony with that which is to be; and while we stand in reverence before the grandeur of the Creative Conception as a whole, there breaks from it such lightness of fancy, such richness of invention, such variety and vividness of color, nay, even the ripple of mirthfulness—for Nature has its humorous side also—that we lose our grasp of its completeness in wonder at its details, and our sense of its unity is clouded by its marvelous fertility. There may seem to be an irreverence in thus characterizing the Creative Thought by epithets which we derive from the exercise of our own mental faculties; but it is nevertheless true, that, the nearer we come to Nature, the more does it seem to us that all our intellectual endowments are merely the echo of the Almighty Mind, and that the eternal archetypes of all manifestations of thought in man are found in the Creation of which he is the crowning work.

In no group of the animal kingdom is the fertility of invention more striking than in the Crinoids. They seem like the productions of one who handles his work with an infinite ease and delight, taking pleasure in presenting the same thought under a thousand different aspects. Some new cut of the plates, some slight change in their relative position is constantly varying their outlines, from a close cup to an open crown, from the long pear-shaped oval of the calyx in some to its circular or square or pentagonal form in others. An angle that is simple in one projects by a fold of the surface and becomes a flutid column in another; a plate that was smooth but now has here a symmetrical figure upon it drawn in beaded lines; the stem which is perfectly unbroken in one, except by the transverse divisions common to them all, in the next puts out feathery plumes at every such transverse break. In some the plates of the stem are all rigid and firmly soldered together; in others they are articulated upon each other in such a manner as to give it the greatest flexibility, and allow the seeming flower to wave and bend upon its stalk. It would require an endless number of illustrations to give even a faint idea of the variety of these fossil Crinoids. There is no change that the fancy can suggest within the limits of the same structure that does not find expression among them. Since I have become intimate with their wonderful complications, I have sometimes amused myself with anticipating some new variation of the theme, by the introduction of some undescribed structural complication, and then seeking for it among the specimens at my command, and I have never failed to find it in one or other of these ever-changing forms.

And now let me ask—is it my ingenuity that has imposed upon these structures the conclusion I have drawn from them?—have I so combined them in my thought that they have become to me a plastic form, out of which I draw a crinoid, an ophiuran, a star fish, a sea-urchin, or a holothurian at will? or is this structural idea inherent in them all, so that every observer who has a true insight into their organization must find it written there? Had our scientific results anything to do with our invention, every naturalist's conclusions would be colored by his individual opinions; but when we find all naturalists converging more and more toward each other, arriving as their knowledge increases, at exactly the same views, then we must believe that these structures are the Creative ideas in living reality. In other words, so far as there is truth in them, our systems are what they are, not because Aristotle, Linnæus, Cuvier, or all the men who ever studied Nature, have so thought and so expressed their thought, but because God so thought and so expressed His thought in material forms when He laid the plan of Creation, and when man himself existed only in the intellectual conception of his maker.