The Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY

At No. 37 Park Row (Park Building), New York.

O. D. MUNN, S. H. WALES, A. E. BEACH.

TERMS—Two Dollars per annum—One Dollar in advance, and the remainder in six months

Single copies of the paper are on sale at the office of publication, and at all periodical stores in the United States and Canada.

Sampson Low, Son & Co., the American Booksellers, No. 47 Ludgate Hill, London, England, are the British Agents to receive subscriptions for the SCIENTIFIC AMERICAN.

☞ See Prospectus on last page. No travelling agents employed.

VOL. VII. NO. 2.....[NEW SERIES.].....*Eighteenth Year.*

NEW YORK, SATURDAY, JULY 12, 1862.

SIX GOOD REASONS WHY EVERY MANUFACTURER, MECHANIC, INVENTOR AND ARTIZAN SHOULD BECOME A PATRON OF THE "SCIENTIFIC AMERICAN."

I. It is a publication devoted especially to their several interests. Every number contains 16 pages of useful matter pertaining to mechanism, new discoveries and inventions, themes interesting and useful to all persons engaged or interested in mechanical or manufacturing pursuits of whatever kind.

II. It is a cheap publication—furnished so low, in fact, that no mechanic, manufacturer, or inventor can plead inability to spare from his earnings or business the small sum charged for a year's subscription.

III. It is printed on the finest quality of paper, in a form for binding, every number being embellished with original engravings of new machinery and inventions, all of which are prepared expressly for this publication.

IV. No other paper or periodical published in this country contains the list of patents and claims issued from the United States Patent Office; hence, the SCIENTIFIC AMERICAN is indispensable to every mechanic, manufacturer or inventor who is desirous of keeping advised as to what new machines or novelties are being patented.

V. In subscribing for the SCIENTIFIC AMERICAN, the reader receives the latest foreign as well as home intelligence on all subjects pertaining to the industrial pursuits of the world. All the best scientific or mechanical periodicals published in England, France or Germany are received at this office, affording us facilities for presenting to our readers the very latest news relating to science or mechanics in the old world.

VI. Subscribers who preserve their numbers have, at the end of the year, two handsome volumes of 416 pages each, containing several hundred engravings, worth, as a work of reference, many times the price of subscription.

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