Nasmyth's Improvements in Forging Heavy Masses of Iron.

The following paper was read before the last meeting of the British Association for the Advancement of Science, at Edinburgh by Mr. James Nasmyth, the inventor of the steam hammer. It is a subject of great interest and importance to many of our readers :—

Mr. Nasmyth instanced several cases in which paddle-shafts of marine engines had given way, although, in the first instance, they had all the outward aspect of the most perfect soundness, but which, on fracture, exhibited the existence of original defect, in being little else, internally, than a mass or bundle of loose bars of iron, which had never been in a sound welded union, but had only been held together by the exterior, where alone the welding had been so far perfect.

The chief cause of such defects was traced to the action induced on the centre part of the metal of such shafts, by the action of hammering such cylindrical forms between two flat surfaces, as is the case of the forge hammer and anvil of the ordinary construction.

Mr. Nasmyth exhibited a diagram, of which fig. 1 is a copy, in order to illustrate the action induced on the centre portion of a cylindrical forging, when produced under the action of a flat faced hammer and anvil.

It will be seen at once that the action induced on the centre portion of the metal of a shaft or such like cylindrical form, by the successive blows of a flat-faced hammer and anvil, as A and B, is to cause the work to spread out or extend in the direction of E D, E C (as represented by the double pointed arrow in the figure), and as the flattened out form has to be attempted to be corrected by turning the shaft round and round on the anvil, so that each successive blow may be made to correct the spreading out caused by the previous blow, the result of this action is a fretting or mincing of the centre part of the metal of the shaft, resulting in the separation of the metal throughout the entire centre portion of the shaft, somewhat after the manner indicated in fig. 2, frequently to such an extent as to permit the passage of air or water from end to end of shafts forged in this manner. The effect of this kind of unsoundness is, that it is certain, sooner or later, to work out towards the exterior, and in all probability, result in a "break down" more or less disastrous in its consequences.

Mr. Nasmyth then proceeded to describe his improved form of anvil face, by the employment of which all such defects as detailed above are avoided. Such has been the perfect success and excellent results which have attended the use of his improved anvil face, that its adoption has become universal, and the production of absolutely sound, solid wrought iron shafts, of whatever magnitude, rendered equally easy as certain.

A, fig. 3, represents the form of Mr. Nasmyth's improved anvil face, which he terms a V anvil, between the jaws of which the work to be hammered is placed, as indicated by a cylindrical shaft seen in section marked C, C, C. A glance at fig. 3 will, no doubt, render its action evident—viz., that the effect of each blow of the hammer on the work, C, C, C, instead of causing as in the case of fig. 1, a diverging action on the centre portion of the work, occasions, on the contrary, a converging action, as represented by the three arrows, and instead of having the centre portion of the metal of the shaft rendered less compact and solid by the action of the blows of the hammer, we have quite the contrary effect produced; besides which, owing to the wedge-like form and action of this V anvil face, the compressing effect of the blow is most importantly enhanced, and the ease and rapidity with which such cylindrical work as shafts and the like can be produced by such means, is most remarkable, so much as to enable the forgeman to hammer out at one heat, by means of this V anvil, as much as would require three heats on the common flat-faced anvil; add to which the vast convenience which the fork-like form of the V anvil yields, in keeping the work at all times right under the centre of the hammer, as it turned round and round to receive the successive blows, which, in case of work of the largest class, is a matter of no small trouble. Another advantage consists in the free passage, or exit, which is at all times preserved for the escape of the scales and impurities which fall from the hot iron during the process of hammering, which scales fall down towards the apex of the V at D, and trickle away—thus removing the cause of blemish and roughness which is occasioned by such scales collecting on the face of the flat anvil, and getting beat into the surface of the forging.

It will be seen, on inspecting fig. 3, that one such V anvil face as there represented will accommodate a vast range of diameter of work, namely, all diameters such as will neither absolutely rest on the bottom of the apex, D, or on the corners, F F.

Fig. 1.

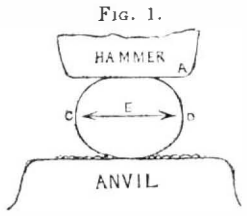
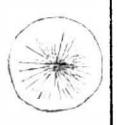


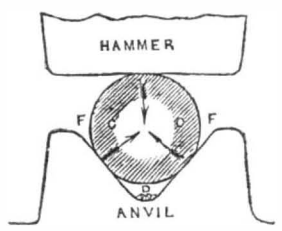
Fig. 2.



Mr. Nasmyth has taken every means by the most free communication to promulgate among those interested the advantages of this V anvil, and has been rewarded by seeing its use become almost universal. Mr. Nasmyth stated that an angle of 80° was found by him to be most generally suitable for the inclination of the sides of the V, and also that the edges should be well rounded off, and the surface of the V sides curved in the direction of the axis of the work to the extent of ⅛th of an inch in 12 inches, so as to be "prowd" in the centre, and facilitate the extennion (axis ways) of the work. The great simplicity, as well as the important results which are yielded by the employment of this V anvil face, has in no small degree, contributed to its almost universal adoption. Its employment renders the production of perfect sound work easy and certain.

Mr. Nasmyth next proceeded to describe the second part of his improvements in forging iron, which consists, as in the first case, of means equally certain and simple in producing sound boiler-plates. Mr. Nasmyth prefaced the description of his improvements on this truly important subject by detailing the nature of the most frequent cause of unsoundness of iron forgings generally, and in boiler-plates in particular—namely: the imperfect expulsion of the molten oxide of iron "scoria," or "cinder," as it is termed, which, in every case of welding hot iron covers and clings to the surface of the metal; and, if left interposing between the welded surfaces, is certain to occasion a defect greater or less, according to the

Fig. 3.



surface of junction it occupies. The frequency of this interposing scoria as the true cause of unsound forged work, was forcibly alluded to by Mr. Nasmyth, and shown to be the most fertile source and cause of the failure of wrought iron work, resulting as such too frequently does in the most sad and disastrous accidents—such as the failure of the links of chains and anchors, and in the costly and often distressing results arising from defective (*i. e*, blistered) boiler-plates.

It respect to the links of chains, Mr. Nasmyth mentioned as the result of an extensive series of experiments on the strength of chain cables, on which, as member of the "committee on metals," he was employed by the Admiralty, out of every 10 cases of fracture, eight were occasioned by defective welding, as evinced by the appearance of the surfaces, which present to a practical eye appearances not to be mistaken, owing to the very peculiar aspect of the surfaces of the apparently welded metal, between which surfaces the oxide or scoria had not been duly expressed.

Mr. Nasmyth further described the condition absolutely requisite to perfect welding—namely: not merely that the surfaces we desire to weld should be really "welding hot," but also that, when brought into contact, no particle of the scoria, which inevitably clings to the metal while welding hot, should be permitted to remain interposing between such surfaces. If such material is left interposing, we are certain to have defect and unsoundness, to a greater or less extent, as the result.

In order the more clearly to detail his improvements on this important subject, Mr. Nasmyth exhibited a colored drawing, representing the usual form and arrangement of a "pile" of "slabs," such as are employed when welded together, to form a mass of iron, from which boiler-plates, or bars of iron, are rolled. Fig. 4 represents such a "pile" of "slabs" which, having been, as is generally the case, produced under the action of a forge hammer and anvil, having flat or, as is generally the case, slightly concave surfaces, causes the slabs so produced to have certain hollow parts, or slightly concave portions of their surfaces, so that, when piled one upon the other, as in fig. 4, the risk of having hollow spaces is almost certain. The hollow spaces are represented in the figure by the dark irregular lines between the slabs.

Referring to fig. 4, A B C D, represent a pile of four slabs, laid on the anvil welding hot. Owing to the concave irregularities of the surfaces; the parts most certain to come into contact first are generally the exterior edges of the slabs. The effect of the blows of the hammer first weld the parts in natural contact, and by continuance of the blows the interposing scoria, or cinder, is expressed in a degree more or less perfectly, according to the energy of the blows, and the deepness of the concave, or hollow patches, betwixt the slabs.

Fig. 4.

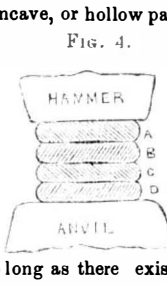
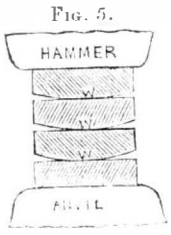


Fig. 5.



So long as there exists an exit or passage, for the scoria all is well; but, as generally happens, some portion of the scoria lurks behind, after all chance of escape is removed by the welding of the exterior portion of the surfaces of the slabs. The result of this is that we have, to a certainty, a defect, greater or less in amount, according to the quantity, or surface, over which the enclosed scoria extends. Once such scoria is shut up between the surfaces of the slabs no amount of after hammering will ever expel it, but, on the contrary, will only tend to its extension over a larger surface; and, as before said, so long as a particle of this scoria is left interposing, so have we a degree of unsoundness in proportion.

Great as this evil is, and common as it is, as a fertile cause of defective iron-work, and the more especially so in the case of boiler-plates, the means of avoiding such source and cause of defect is as simple as the results are important; and it is to be hoped that the free and open communication which Mr. Nasmyth has made of his views on this subject will be answered in the most acceptable way by the general adoption of his improvement, as a certain means of avioding the occurrence and existence of all such causes of defective boiler-plates and forge work generally, which improvement consists simply in so forming the surfaces which we desire to weld together that a free exit may be preserved to the last for the escape of the molten oxide, or scoria, until the entire surfaces of the parts we desire to weld are thoroughly incorporated by the welding property under the action of the hammer, or rolls, as the case may be.

In order to accomplish this most important and desirable object, Mr. Nasmyth forms the surfaces of his slabs convex (see fig. 5), by which simple means a most perfect free exit to the scoria or interposing impurity is maintained to the last moment, the welding commencing at the centre part of the contact, W, and extending outwards towards the edges under the action of the successive blows of the hammer, or squeeze of the rolls; but, as before said, an open door is kept for the escape of the scoria, until the surfaces unite from the centre, W, to the outside edge Here, then, by an arrangement or formation of the surfaces we desire to weld, we have the most certain and simple means of procuring a perfectly solid sound mass of iron, which, when beaten, hammered, or rolled down to whatever thickness we desire, will retain to the last all the qualities of the one sound solid mass we had converted it into by this most simple improvement—viz., giving to the surfaces we desire to weld a convex form, and relation to each other.

Mr. Nasmyth concluded his observations on these important subjects by an earnest appeal to the members of the mechanical section to diffuse, by all means in their power, the information which, on this as on all such subjects, he will ever feel the highest pleasure in communicating to the practical men of his profession, who may think fit to accept these results of an active life, which he finds so much pleasure in freely sharing with them.

Passages of the Atlantic Mail Steamships from Liverpool to New York, from Jan. 1 to April 3, 1851.

The Franklin, (Am.), from Cowes, England, arrived at New York on Thursday, Jan. 16, at 9 P. M., after a passage of 14 days and 6 hours. [This passage is noted as a good one, because out of the regular list.]

The Asia (Br.) arrived on Friday, Jan. 17, at 9 P. M., after a passage of 13 days 9 hours from Liverpool.

The Arctic (Am.) arrived at New York on Monday, 27th Jan., at 8 P. M.: left Liverpool at M. on the 11th—passage 16 days 8 hours. Ran short of coal and had to put into Halifax on Friday, 24th.

The Africa (Br.) arrived at New York, on Saturday evening, 8 o'clock, Feb. 1,—passage 14 days and 9 hours. This vessel brought word of the safety of the Atlantic. The Atlantic left Liverpool Dec. 28, 1850. She broke her shaft when about half way across, and after battling some time with the tempest, put back. She arrived at Cork on the 22nd Jan. The captain of the Africa, before his vessel touched the dock, spoke through his trumpet, announcing the safety of the Atlantic. The news flew through the city like a shock of electricity, as it was supposed she had been lost.

The Baltic (Am.) arrived at New York on Thursday, at 1½ P. M., 20th Feb.,—passage 12 days. Left Liverpool Feb. 8, at 1 P. M.

The Pacific (American) arrived at New York on Thursday, March 6, at 5 P. M.,—passage 12 days 2 hours. She left Liverpool on Saturday, Feb. 22, at 1 P. M.

The Asia (Br.) arrived at New York on Friday, March 14, at 8 A. M.,—passage 12 days 20 hours.

[The Franklin, from Cowes, arrived at New York on Saturday, March 22, making another passage of 14 days.]

The Arctic (Am.) arrived at New York on Sunday, March 23, at 8 A. M.,—passage 14 days 18 hours. She left Liverpool on the 8th.

The Baltic (Am.) arrived at New York on Thursday, April 3, at 8 P. M.,—passage 12 days 8 hours.

The Cunard and Collins Steamers.

From a statement compiled for the London Times from a parliamentary document, it appears that the Cunard company receive from the British Government £145,000 per annum, or equal to £3,300 per voyage, while the Collins line receives from the American Government $383,000 per annum, equal to $4,000 per voyage—the Collins' company undertaking to make twenty voyages out and home in the year, and the Cunard company forty-four voyages. The former, therefore, get double the pay of the latter.

[The above we have seen in a great number of papers. The amount for each Collins' vessel by the above account, for 20 voyages, is $19,150; but is the Times correct. Who gave the information that only 20 voyages were to be performed yearly for $383,000? This would be a fat job indeed, and would pay well. How foolish to get 5 steamships built when two could make money by such a bonus.