**"ON THE ADAPTATION OF THE 'CAMBRIAN ENGINE'
TO LOCOMOTIVE PURPOSES.**

"The following is a brief description of the advantages to be derived by the application of my Patent Cambrian Engine to locomotive purposes. One has already been made by Thwaites and Co., Engineers, of Bradford, named the 'Albion,' which, I understand, gives every satisfaction.

"On referring to the drawings which accompany this paper, it will be seen that the side elevation, No. 5, shews the side levers as connected to the wheels. The levers are fitted on to the ends of the piston shafts, which work in separate bearings; from the opposite ends of these levers pass connecting rods to the crank pins on the leading and centre driving wheels; on each side of the engine, the pistons communicate an oscillating motion to the double levers, the length of which is so adjusted as to cause the driving wheels to make whole revolutions; by this arrangement the strain of the working parts is balanced: there is no centre pressure, and all dangerous oscillation is completely avoided.

"Another advantage derived from the mode of connection, is the oscillating lever ends passing through a great part of a circle, gaining power, as it does, at the extremities of the stroke, to compensate for the loss of power in the cranks, as they approach the dead centres. The circle that the crank pin centre moves through is divided into twenty parts.

"It may be seen by the diagram that, as the lever approaches the extremities of its stroke, the actual length diminishes, and becomes from 18 inches to $17\frac{1}{2}$, 16, $15\frac{1}{4}$, 14, and $13\frac{1}{2}$ inches at the centres, so that the power of the lever increases in proportion to its diminution in length; which compensates in a great measure for the loss of power in the crank, as it approaches the dead centres.

"I presume the principle of the 'Cambrian Engine' is tolerably well known, as it has now been before the public upwards of seven years; several having been at work for more than six years, to the entire satisfaction of the parties using them. I therefore feel satisfied as to its superiority over the common cylinder engine, as the wear and tear is much less, in consequence of there being fewer working parts.

"I have now pointed out what I consider to be the advantages of this engine; viz:

"Obtaining a long stroke in the crank, without the disadvantages of a long stroked cylinder, where high velocities are required.

"The arrangement of the levers which balance the engine.

"The entire disappearance of any oscillating motion of the engine.

"Doing away with all centre pressure, an object of the highest importance, and one that deserves more attention than it has hitherto received.

"JOHN JONES,

*Great Western Iron Steam Ship Works,
Bristol, 11th October, 1848."*

In the absence of Mr. Jones, and at the request of the Chairman, Mr. E. A. Cowper, with the assistance of diagrams, further explained the construction of the engine, commonly known as the "Cambrian Engine;" but added, that as applied to locomotion he had never seen it until that morning. In answer to numerous questions Mr. Cowper stated, that although he did not altogether recommend the "Cambrian," he had often known it to work satisfactorily. As compared with ordinary engines he could not see any great advantage in it.

In answer to a question, Mr. SLATE stated that he had had some experience with rotary engines, which the Cambrian engine somewhat resembled, and the conclusion he had come to was by no means favourable to that principle. At the same time, he did not see any difficulty with Mr. Jones's patent; and as far as he could perceive, the difference between it and the ordinary engines consisted in the fact, that the "Cambrian" had the advantage of having the principle weight between the wheels, whereas, by the ordinary arrangement, the weight was in front of the driving wheel. In other respects, the "Cambrian" very much resembled the locomotive lately made by Mr. Wilson, of Leeds; the principle difference being, that in the latter there was a strain on the bearing of the centre shaft, which he did not find in the former; otherwise, the action of the balancing of the engine was exactly the same.

Mr. CRAMPTON said, there were two bearings of the shaft to which Mr. Slate referred. He had paid some attention to this matter, and he thought that the intention was to balance the engine, or locomotive, with the momentum of the parts, so as to avoid oscillation. He would show a practical objection which he conceived to exist: suppose three shafts in a right line, with a lever for the centre shaft, and a crank on either side; when in a perfectly straight line, the lengths remained the same; and if on a table, or on any perfectly smooth surface, it worked as sweetly as possible. On a railway, however, supposing there to be three wheels, and the road to be a little out of order, the one shaft would be thrown out of the line referred to, and as the spring deflected $\frac{3}{4}$ of an inch, it would have the tendency to lengthen the connecting rod, which could not revolve past the

centres without straining the parts, but which, with the ordinary connecting rod, would produce no bad effect.

The CHAIRMAN said, that there certainly seemed to be an objection; in fact the line of the three centres would be destroyed.

Mr. CRAMPTON :—The thing works perfectly when the parts are in one line ; but as soon as they get out of the line, there is an undue strain.

In reply to Mr. Peacock, Mr. CRAMPTON admitted that additional bearings might be put on to the axles of the wheels, with cross bars to carry the cylinders and bearings of centre shaft ; but it would be found to involve an extra ton or two in weight, which could not be afforded.

Mr. PEACOCK :—In the case of Wilson's Engine, where there were only axles, shafts, and cross bars, the objection would not be so great.

The CHAIRMAN :—It would be greater in the Cambrian engine than in Wilson's ; because, in the former there is a cylinder to support.

Mr. SLATE did not see that a little extra weight between the shaft and the cylinder would be of material effect, it being supported from the axle. If it supported five cwt. it could support fifteen. Perhaps Mr. Peacock would favor the meeting with his opinion of the oscillating shaft ?

Mr. PEACOCK had not had sufficient experience ; but as far as he could see, it appeared to work beautifully. As to the outside levers, he had heard no complaint of inconvenience ; in fact, it must be a very serious thing that would cause the shaft to deviate an inch from the right line, and then it would be but for a moment. In Wilson's engine, the shaft was supported from the frame of the boiler, and when the whole weight of the engine was on the springs, they might imagine the three shafts, or centres, to be in a right line,—and any deviation from it would be but for a moment, as it would immediately regain its position, unless the springs were broken. From his experience of Wilson's engine, he had no objection to the levers being outside ; but how long these might stand, was a different thing.

Mr. CRAMPTON had never seen any engine work so beautifully and steadily as Wilson's locomotive. His objections were principally of a practical kind. He maintained that that engine could

not be kept right for any length of time. It was inherent in it to increase or diminish the length of the connecting rods by $\frac{1}{8}$ th of an inch. In the actual working of a railway, the engines could not always pass under the observation of the superintendent,—and hence durability was a matter of great importance. At the same time, he must tell them what he had seen,—and on an even surface he had never seen a steadier working engine. All the weight was between the two rods, which he considered to be the great reason why the oscillation was avoided.

Mr. SLATE gave it as his opinion, that, with reference to the question of the form of the cylinder, he could not see that the form of the vessel was of any particular consequence, so that the space be filled with steam. The power derived will be just equal to the quantity of steam contained in the cylinder. In that view, he saw nothing to object to in the circular form of the Cambrian's cylinder; and, otherwise, the engine under consideration had good points. The outside levers and the two cranks worked admirably; and the only question was whether it would support a cylinder of the weight required between the two shafts. He saw no objection to the application of the "Cambrian" to locomotive purposes; but he did not feel quite competent to give a positive opinion.

Mr. COWPER said, that Mr. Crosley, a party interested in the engine, had told him that it had been tried on the line between Birmingham and Derby, and that it not only burnt five pounds of fuel per mile less, but took a heavier load than any other engine.

Mr. HUMPHREYS was rather inclined to think that it would go forth that the principle of the invention had met with the approbation of the meeting; but, as far as he had been able to discover, he could not see any reason why steam applied in this particular way should do better than in the ordinary way of a simple cylinder. As Mr. Cowper had had considerable practice in steam engines, he wished to know, if, in making a steam engine, he would be disposed to adopt Mr. Jones's plan?

Mr. COWPER begged to guard himself against the supposition that he saw any advantage in the plan, or in the form of the cylinder.

Mr. HUMPHREYS could only record his own opinion, that no possible advantage could be obtained by so applying the steam;

but, on the contrary, a disadvantage; for they had to get over the difficulty of connecting all the joints.

Mr. COWPER said, the cylinder was perfectly tight.

Mr. SLATE did not consider that, in the absence of Mr. Jones, they were in possession of sufficient information to enable them to arrive at a decision on the merits of the patent. At present, they had no particulars as to the size of the engine, the pressure of the steam, the size of the connecting gear, and various other matters.

Mr. P. R. JACKSON expressed it as his opinion, that the Rotary engine was a far better application to locomotion than the Cambrian engine. He well recollected a gentleman calling at his foundry, in Manchester, some years ago, and in compliance with that gentleman's request, he cast for him the parts of a rotary engine; at the same time expressing his opinion, that it would do no good. The engine, however, was completed; it cost the inventor £400, and in two years afterwards it came back to him for £14.

Mr. COWPER remarked, that the objections of Mr. Crampton extended to the coupling of any engine; for as one wheel went up, and the other down, the connecting rod must vary. It did not hold to the same extent in all cases; but still it did hold.

Mr. SLATE inquired, whether the objection might not be overcome by making the guard plates a little larger?

Mr. CRAMPTON replied, that this was being done; but he conceived there was a still greater objection to that alteration.

The CHAIRMAN thought they had not sufficient data before them as to the economy of the engine, or even as to its adaptation to the purpose designed, to enable the meeting to form a correct opinion. He therefore presumed that, at present, it would be premature to come to a conclusion as to its merits.

Mr. BEYER gave it as his decided opinion, that the ordinary straight cylinder would work better than the curved one of the Cambrian.