Engineering, Civil & Mechanical.

HIGH SPEEDS AND THE MECHANICAL THEORY OF HEAT.

Amongst engineers in the United States there has lately sprung up a great desire for high speeds or for high revolution numbers, a desire which is mainly the outcome of a study of the mechanical theory of heat. That theory points clearly to the fact that to increase the theoretical efficiency of any kind of heat-engine, the temperature of the fluid at its entrance to the cylinder, or at the time when it commences to do work, should be raised as high as possible, while the temperature at exhaust should be lowered as much as possible. The application of this principle to steam-engines involved the use of high pressure and great expansion; but when these were tried within limits, the results expected were not realized to the extent desired and theoretically possible. We need not recapitulate the reasons why compounding did not prove so efficacious as was expected; why the steam jacket is not so practically efficient as it ought to be theoretically; nor why high speeds have failed to yield the results expected. They are well known to engineers, and though not entirely satisfactory, they have all greatly reduced the loss from condensation, and are not likely to be given up. A study of the mechanical theory of heat discloses the fact that it is only by the use of superheated steam we can entirely prevent the loss arising from condensation. But there are mechanical reasons why super-heated steam is not more extensively used, just as there are mechanical reasons why the air-engine—theoretically the most perfect of all—has never been extensively adopted. Difficulties discovered in the workshop and in the engine room seem to say—"thus far, and no farther," but so far as we have the theory to teach us the possibility, the probability will remain that better engines, whether steam or gas, air or fluid, will in time be built. For certain purposes, the tendency of engine designers in this country is towards high speeds, but at least one noted firm in America make a speciality of engines running at a very high rate, and claim that they are adapted for all kinds of work. Mr. Edison's new dynamo-machine, for instance, is to be driven by an engine making the extraordinary, not to say excessive, number of 600 revolutions per minute; and lately, Mr. Barnet Le Van proposed, in a paper read before the Franklin Institute, to run a train at the rate of 90 miles an hour between Jersey City and Philadelphia. It will be seen that, even if the driving wheel of the locomotive is 7ft. in diameter, it must make 360 revolutions per minute, that is 720 strokes of the piston and the other reciprocating parts; and if the driving wheel is smaller, this number will be propotionately increased. Mechanics, nowadays, work with skill so admirable, and with such accuracy, that it would be absurd to say that an engine could not be made to travel at that speed, or even a higher one; but it is clear that the risk of a breakdown would be largely increased, while it would also be of the first importance to provide a very firm and strong road-bed. We shall probably give the details of Mr. Barnet Le Van's proposals in a future number; but as they involve the laying out of a new line between the points above-mentioned there is no immediate likelihood of their being carried out. Still, there are several other indications that the Americans are not at all satisfied with existing arrangements, and it is not improbable that before long we shall hear of some developments in the speed of locomotives, as we have already in connection with stationary engines. So far as locomotives are concerned, we, in this country, have little to learn from American engineers, whether as regards speed, tractive-power, or durability; but there will unquestionably be some little curiosity about the "90 miles an hour," should it be attempted. The distance from New York to Philadelphia is, in a straight line, not quite 81 miles, and the rivalry between the competing lines now running trains between those places has whetted the appetite of American travellers for still higher speeds. It is confessedly impossible to do much more on the existing roads, for although the lines may be described as practically level, curves are abundant. For instance, on the Pennsylvania line there are 84 curves in the 88½ miles between Philadelphia and Jersey City, and the longest length of straight line does not exceed 10 miles. On the Bound Brook, a rival route, there are 43 curves, one of which is on the bridge crossing the Delaware. Mr. Le Van says that on a curve of three degrees radius, with the standard gauge, the super-elevation required is less than 5in. for 50 miles an hour, but would require to be 16in. at 90 miles an hour. One of the competing lines allows 1in. of super-elevation for each degree of curvature, but draws the line at 5in., beyond which super-elevation is not allowed to be practised. The speed must be reduced to suit the curve: hence there is a limitation to speed on the existing roads. After a careful study of the question and of the country, Mr. Le Van said he was satisfied that a paying road could be built to run in a straight line from New York to Philadelphia, reducing the distance by about 10 miles, and enabling trains to be run through in sixty minutes, allowing for the slow speed at the ends. The only curves would be two of 10,000ft. radius, and no roads would be crossed at grade. Mr. Nystrom thought there would be no difficulty in accomplishing the distance in less time than Mr. Le Van had stated, so far as driving the engine was concerned. These statements derive importance from the fact that they were made before the most scientific institution in America, and in a city which is interested in the subject.

So far as high speeds are concerned in stationary engines the problem is much simplified, as any speed may be said to be possible, short of knocking the engine to pieces. The Edison engine is of the Porter-Allen type, a simple reciprocating piston in a cylinder, having a diameter nearly equal to its stroke, and, as mentioned above, is to run at 600 revolutions per minute. A high-speed rotary engine, the invention of M. Tagnander, has been recently introduced for driving dynamo-machines, and that runs at 800 revolutions per minute. The cylinder has four chambers and pistons, and the steam acts on the bottom and top of each alternate piston in such a way that the moving parts are balanced with nicety, and their weight concentrated on the central line of the frame. The engine is said to have run for eight months perfectly steam-tight without the packing being touched. In principle it is of a very old type, and has been frequently re-invented. It is generally known as the disk engine, and will probably be found in Reuleaux's "Kinematics of Machinery," under the head of "Chamber-crank Trains," a chapter of which contains nearly all the rotary engines ever devised. For the special purpose of dynamo-machines and for propelling small yachts, the rotary principle may possibly come into some favour, especially where high speed is the essential, and disadvantages are disregarded if that can be maintained. But it is doubtful if it can be worked with economy.—*British Mechanic.*

THE PROPOSED IRON AND STEEL ASSOCIATION.

The proposal has been made that those interested in iron production in Canada should form themselves into an association, the object of which would be the promotion by all lawful means, of such legislation as will create a basis of security for the investment of capital in the business. We need scarcely enlarge upon the power of the associate and concerted action of many to bring about results for which invividual unconnected effort might labour everlastingly in vain. The English Anti-Corn Law League lives in history as the first great example of combination for a specific economic purpose, conducted in such a way as to harmonize with the genius of a free people and free institutions. Since that first great success there have been many smaller ones, all showing what can be effected by men who are in earnest, and combined for a purpose. That the Dominion would benefit by millions annually were its vast treasures of ore in course of being transmuted into merchantable iron at home, is what nobody denies; but just as clearly does it appear that without legislation for the express purpose, no beginning worth speaking of will ever be made. All hope of any large extended development of iron production in Canada without tariff charges such as will give confidence to capitalists may be dismissed as utterly vain and futile; and it is but idle talk which would encourage it. Under exceptional circumstances an individual like Mr. McDOUGALL of Three Rivers, or a company like that of Londonderry, may make a limited business in special lines; and the enterprising men engaged in those ventures deserve high credit for the value of their example before the country; but it is plain that without more N. P. legislation they will have few imitators. The Government which gave Canada a National Policy is doubtless able to bring iron production as well as other industries within the sphere of its vivifying influence; but for further steps a strong and unmistakeable backing of public opinion is imperatively required. It is for those who are specially interested in the development of iron making in Canada to appear and show cause before the public in the matter. If they want the Government to do something, and public opinion to sustain the Government in doing it, they should be able to give the reason why. In order to do this, association is necessary; the work is beyond the power of any individual. Association for all sorts of purposes is an old story with us now; and it should not require much urging to show the application of the principle to the present case. The latest and nearest example for us is that of the American Iron and Steel Association, some particulars regarding which we will at an early day lay before our readers. —*Industrial World.*