

1964

THE CANADIAN MAGAZINE

OF
SCIENCE AND THE INDUSTRIAL ARTS.

Patent Office Record.

Vol. XIX.

JANUARY, 1891.

No. 1.

THE EFFICIENCY OF STEAM JACKETS.

In the articles on "Steam Engine Economy," and in the consequent correspondence on the subject, which have appeared in our columns, there is a factor in the problem which has scarcely been touched upon, and which ought to be carefully examined and discussed—namely, the effect of a steam jacket on the efficiency of the steam used in the cylinder of an engine. We have been favoured by Professor Thurston, of Cornell University, with the advance copy of a paper which he read at a recent meeting of the American Society of Mechanical Engineers, entitled "Authorities on the Steam Jacket; Facts and Current Opinions." If this paper does not settle much, it at least gives a great deal of information and useful data relating to engines of different types, and working under different conditions, which will enable engineers to form opinions regarding the different cases which occur in their daily practice. Professor Thurston heads his paper with a quotation from Hirn, which states that the useful effects of the steam jacket have been alternately affirmed and denied so often that the public do not know what to believe regarding them. This may be true of the general public, but almost all intelligent engineers have been able, partly from instinct and partly from experience, to use the steam jacket in such a manner as to increase the efficiency of the steam. We must confess, indeed, that we have known some exceptions to this rule, but these cases were sufficiently astounding to lead us to doubt whether those who were responsible for them had ever devoted any serious attention to the matter.

In considering this subject we desire, in the first place, to take exception to a remark made by a contemporary when discussing Professor Thurston's paper, to the effect that "it is a curious thing that while those versed in thermodynamics hold that jackets must be economical, those who build and use engines constantly assert that they are of no economic value whatever, or that at best they are not worth what they cost." The first part of this statement is certainly not correct. The state of the matter is clearly put in an opinion quoted by Professor Thurston, to the effect that the use of a steam jacket as ordinarily designed is a violation of a fundamental law of maximum efficiency of heat engines. This law requires that the engines should receive all their heat

at the maximum and give it out at the minimum temperature, and not, as in the case of an engine with a steam jacket, at temperatures between these, and at times when the heat imparted lessens the efficiency, which it evidently must do at and near the end of the stroke. The steam jacket may thus be looked upon as a necessary evil, justified only by the physical properties of steam and of the materials hitherto used in the construction of engines. The advantage to be derived from the use of a steam jacket, therefore, varies according to the circumstances under which it is employed, and in some cases—as, for instance, when low rates of expansion are used—the jacket may not only be useless, but wasteful. On the other hand, when high rates of expansion are used, by preventing the temperature of the cylinder from falling below the boiling point corresponding to the initial pressure of the steam, the economy resulting from the action of the jacket is considerable. The necessity for a careful study of the conditions of efficiency of a steam jacket, of care in its application, and of experiments to test its effects are thus evident.

The teachings of theory and the results of practice are thus the same, as should be expected. Of course the theory must be formed by taking all the conditions of the problem into account. The interesting historical *résumé* of the question which Professor Thurston gives amply confirms this statement, and proves that if the steam jacket be employed under proper conditions it leads to an increase of efficiency. Like many other improvements on the steam engine, the steam jacket owes its origin to James Watt, but there is not sufficient evidence to show whether he fully understood its action, or whether instinct led him in the direction in which economy was to be obtained. His immediate successors certainly did not understand it, the common opinion being that it only served to prevent radiation from the external surface of the cylinder, and as the jacket presented a greater surface than the cylinder they inferred that it was not only unnecessary but wasteful. Its use was, therefore, abandoned to a large extent in land engines, and entirely in marine engines. Professor Thurston traces the history of the subject from the time of Watt, and dwells especially on the writings of Clark, Isherwood, Rankine, and Clausius, as these writers in later days directed attention to the importance of the action of the sides of the cylinder on the steam, and