

**RAILWAY ECONOMY: USE
OF COUNTER-PRESSURE
STEAM IN THE LOCOMOTIVE
ENGINE AS A BRAKE**

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Railway economy: use of counter-pressure steam in the locomotive engine as a brake by L. Le Chatelier

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L. LE CHATELIER

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RAILWAY ECONOMY

USE OF COUNTER-PRESSURE STEAM IN THE
LOCOMOTIVE ENGINE AS A BRAKE

BY

M. L. LE CHATELIER

INGÉNIEUR EN CHEF DES MINES

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INTRODUCTION.

For some years past attempts have been made to overcome the inconveniences of "reversing steam," so as to enable the driver to utilize, without difficulty or danger of any kind, the work done during the inverted action of the locomotive engine, for regulating and checking the speed of trains in descending long steep gradients.

In France, M. Beugnot; in Austria, M. Zeh, have experimented with closed exhaust nozzle, the one so as to cause a vacuum behind the pistons, the other to establish a pressure behind the piston, and thus avoid drawing in the heated gases of combustion from the smoke-box.

In the beginning of 1865, Mr. De Bergue experimented with a system of brake by compressed air, ingeniously arranged so as to prevent the introduction of the fixed gases into the boiler. This system gave satisfactory results for short runs of two or three minutes; but, like the others, it did not answer when the action was prolonged.

In July 1865, M. Le Chatelier directed experiments to be made on this important subject on altogether a new principle. His ideas have been put in practice with a success so complete, that in France and Spain his system is now applied to above two thousand engines. In Germany it has also been recently introduced.

In a *Mémoire sur la Marche à Contre-Vapeur des Machines Locomotives*,¹ published by M. Le Chatelier in April of this year, a *Notice Historique* of the commencement and early progress of this system is given.

¹ Paris, 1869. Chez Dunod, Éditeur. Quai des Augustins, 49.

From the documents appended to that *Notice*, it is quite evident that the engineers of the *Chemin de Fer du Nord de l'Espagne*, being under M. Le Chatelier's orders as engineer-in-chief, received his instructions, but conducted the experiments with an imperfect conception of those instructions, and with little skill, and thus more than a year was lost in obtaining results which might have been obtained in a fortnight. It was not, indeed, till early in 1869, when M. Le Chatelier himself, relieved of more important duties, took upon himself the practical examination of the question, that the experiments were completed on various railways in France. These experiments have now determined the true solution of the questions which he had proposed on 19th September 1865, and a comprehensive basis has been laid down for all applications of his system for the future.

In the *Mémoire* M. Le Chatelier describes the trials made by the engineers to whom he sent his instructions, and points out the mistakes into which those engineers fell. He also rectifies certain erroneous views of the theory of the subject which have been put forth; and he adds a historical notice, in which his just claims as an inventor are vindicated.

The only object of the present publication is to explain the principles, the mode of application, and the results obtained from M. Le Chatelier's experiments. To the system its author has given the name of *Marche à Contre-Vapeur*,—working with counter-pressure steam,—to distinguish it from the usual expression of *renversement de Vapeur*, reversing steam. The explanation and description of the details relative to the first trials made in Spain, and subsequently by the engineers of the great railway companies of France, and the historical notice, have been omitted.

It will be found that this system of working counter-pressure steam has the following advantages:—

1°. It puts the control of the speed of the train into the hands of the driver of the locomotive himself, giving him a means of

instantaneously using all the load on the driving wheels as a brake, without danger to himself or stoker, and with little physical effort.

2°. It gives a higher degree of security against collisions and over-running stations than has hitherto existed, and greatly facilitates all shunting operations.

3°. It economizes rails, by dispensing in a great measure with the use of the brakes of the tender and brake vans.

4°. It economizes wheel-tires and grease.

5°. It allows of the number of brakemen being permanently reduced.

Again, it has to scientific engineers the interest of being an illustration of the dynamic theory of heat; the *work* of retardation being converted into heat which is in great part sent to the boiler, instead of being wasted in abrading rails and tires, heating pistons, stuffing boxes and wheels, and thereby wasting grease and oil.

To obtain these results, the apparatus required is of extreme simplicity, can be applied to any construction of locomotive at small cost, and without any other alteration of the engine than that of fixing the apparatus upon it.

M. Le Chatelier having asked me to translate his valuable *Mémoire*, I persuaded him to recast it, with the view of adapting it more especially to English readers; and I have translated his manuscript to the best of my ability, happy in the privilege of being permitted to associate my name with that of one of my oldest friends in the publication of an invention so creditable to the well-earned fame of its author, and so important to railway economy.

My only regret is, that the uncertain and feeble state of my health should have caused a delay of nearly three months in offering the following pages to the public.

LEWIS D. B. GORDON.