A PRACTICAL TREATISE ON THE MOVEMENT OF SLIDE VALVES BY ECCENTRICS; FOR THE USE OF ENGINEERS, DRAUGHTSMEN, MACHINISTS, AND STUDENTS IN GENERAL

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BY

ECCENTRICS.

FOR THE USE OF

ENGINEERS, DRAUGHTSMEN, MACHINISTS, AND STUDENTS IN GENERAL.

BY

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PREFATORY REMARKS.

The action of the slide valve of the steam engine, operated through various intervening devices by a motion derived from an eccentric, has been so often and so ably discussed, that in presenting a new treatise on the subject, an explanation seems called for, offering an excuse for its appearance. The object of the present work is that of aiding practical engineers in forming a clear idea of, first, the nature of the motion, and what the valve *can* be made to do; second, the requirements of the engine, and what the valve *must* be made to do; and, third, the construction of the movement, and how to make the valve do what it is to do. And the plea for its existence, upon which main reliance is placed, rests primarily on the manner in which these questions are presented.

Much labor and zeal have been expended, not to say wasted, in treating this matter analytically—the method being to embody the elements, constant and variable, of the whole combination, including all the connecting rods, cranks, eccentrics, rock shafts, links, and levers, making up the working gear interposed between the piston and the valve, in an equation expressing the movement as influenced by them all; and by discussing this equation to deduce results as affected by various supposed changes in the proportions or relations of these elements.

The subject affords a good field for the display of analytical acumen; and this method of employing algebraic skill for a practical purpose is at once elegant and refined; but such investigations do not answer the purposes above set forth; admirable as they may be intrinsically, they are so mainly to the select few as interesting studies of applied mathematics.

It must be borne in mind that of those who study closely the mechanical movements of the steam engine, particularly those who are directly interested in the practical matter of engine building—the draughtsmen who design as well as the mechanics who execute—the great majority are not versed in the higher mathematical branches. And more especially is it true that they are seldom of the order of mind which turns naturally to analysis as a mode of solving problems; the *geometrical* reasoners are the ones most likely to adopt a profession in which graphic methods are in constant use, and to many, proficient in these, any thing written in the language of symbols is a sealed book, while to many more it is a very dry one.

Again, the connection between an abstract formula and its concrete embodiment is so indirect and obscure, that even those competent to trace the equation through its various transformations from the initial to the final stage, have frequent need to resort to graphic means of illustrating their progress, and are absolutely driven back to them in order to construct their ultimate expressions, and reduce their theoretical deductions to a practical form.

It is to be considered, too, that the engine itself is not a creature of analytical instincts; its parts move with geometrical precision, in lines and about centres which, having fixed linear relations to each other, are just as susceptible of accurate delineation on paper as of accurate adjustment in metal; they did so before their motions were analyzed, and would continue to do so to the end of time, though the art of analysis were forgotten. In fact, the mathematical education of the engine has never gone beyond geometry; it was planned by geometry, it was built by geometry, and it runs by geometry. To be sure, you may examine it analytically, and formulate the results; but, algebra or no algebra, it will answer no questions which it cannot answer by geometry.

Since, then, the valve movements must eventually be constructed by graphic processes, whether they be previously discussed analytically or not, there seems to be no good reason why the former method should not be separately used in the whole investigation.

On the contrary, it would appear from the preceding considerations that it is peculiarly adapted, not only to the elucidation of this subject, but to the tastes of those specially addressed; it has, therefore, been adopted, to the entire exclusion of algebraic analysis, which those who prefer it may find exhaustively used in other works.

In regard to the general arrangement and subdivision of the matter presented, it is proper to remark that, in the author's opinion, the chief source of the difficulty often found in imparting, even by the graphic method, a thorough insight into the action of the slide valve, and the construction of its movement, is to be found in the fact that usually the investigation starts out with the three-ported or common slide, very often miscalled "the simplest form of the valve;" and introduces at once the several adjuncts of "lap," "lead," "inside clearance," etc., which, though simple enough when separately considered, are bewildering to the beginner when he is at once confronted with them all.

By dissecting this valve, and considering its members and their functions one by one, the author has endeavored to make their combined action more readily comprehended.

HOBOKEN, *Feb.* 1873.