THE SLIDE VALVE PRACTICALLY CONSIDERED

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BY

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"A POCKET BOOK OF PRACTICAL RULES FOR DESIGNING
LAND AND MARINE ENGINES, BOILERS, ETC."
ETC. ETC. ETC.

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PREFACE.

THE relative position of the engineer to the steam engine may be said, with some truth of comparison, to be analogous to that of the medical man and his patient. Of all the details (so to speak) of the human body, the heart is the most important. The same may be said of the slide valve, in comparison with the remaining details of the engine. In either case the defective action of the heart or valve impedes the progress of the whole.

The present work is intended by the author to enable the student and interested observer to clearly understand the use and action of the slide valve. The rules relating to the equilibrium slide valves have been carefully digested; that portion relating to the "width of the large bar" is, perhaps, the most important of all, while the simplicity is perfect. The delineation of the eccentric circle should he well studied, it being remembered that from it the slide is proportioned. The angles assumed by the cranks at given grades of expansion are matters too often disregarded by the pupil and young engineer. It is not usually appreciated that the arc passed through determines the lap of the valve. In no case whatever

should a valve be designed without first considering the direction of the crank pin, and the amount of expansion required. The proportion of lap to width of opening or port can only be obtained by the means alluded to. The lead of the slide valve has been duly considered in this work. The author would impress that the true versed sine and radius of the arc of supply steam can only be attained, *by noticing the lead.* The time for supply, expansion, exhaustion, and compression has been fully explained, so that its value and defects will be apparent. The delineation of the crank circle has met with due attention, and will be found of utility in proving the actual consumption of the steam at each stroke of the piston.

In the chapter relating to "General Observations" will be found hints worthy of notice. The proportions alluded to are deduced from the best results.

The index will be found lucid and copious, so that the allusion made to any detail in requisition is rendered perceivable *per se.*

The author has carefully avoided theorizing on the subject on which he treats; all his remarks have been deduced from *practical* demonstrations —assumptions have *not* been admitted—therefore the data given will be found exact.

N. P. BURGH.

78, *Southampton Terrace,*
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London, October, 1865.

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CHAP. I.

ANTECEDENTS OF THE SLIDE VALVE AND STEAM PORTS IN THE CYLINDER.

THE steam engine of the past and that of the present widely differ in the consumption of the fuel, or rather steam, per indicated horse power. Twenty years ago, eight to ten pounds of coal per actual horse power was deemed a good result, while in the present day two and a half pounds of coal per horse power is considered but a fair attainment. This great reduction is due to two causes,—perfection of manufacture and arrangement, and the application of natural laws.

The friction due to the surfaces in contact of all bodies are alike in principle. The slide valve may be said to be a body moving on a given area, the pressure of the steam being the load on the same. An idea of the friction imposed can be attained by

multiplying the pressure of the steam per square inch by the area of the surface operated on. This result, multiplied by the co-efficient of motion (the unguent being of course considered), will give the power required to move the valve when under full steam. Many ideas have been promulgated and carried into effect to neutralize the action of the steam on the valve. Some of the means adopted are,—the valve is hollow centrally, or as a frame; the surfaces at the back and face are equal, hence the friction is due only to those parts in contact. Adjustment is attained by a wedge-like division, a band and set studs being introduced to prevent lateral and longitudinal looseness. In another example, the action of the steam preserves the required amount of adjustment, so that the details in the former example are dispensed with.

The lead of the slide valve greatly affects the lap of the valve, this can be understood by remembering that, when the crank is on the horizontal line, the valve is open, due to the lead required. The valve travels back to the extremity of its stroke, and forth to close the port, while the crank pin is traversing through a given arc. The grade of expansion attained, is due to the radius of the arc, passed through by the eccentric centre.

This is fully investigated and explained in the fourth chapter. The rule given for the outside lap, in page 43, does not consider the lead, should the latter be required to be introduced, the true versed sine of the eccentric arc of supply steam, would equal *width of the opening caused by the valve, minus the lead.* In some instances half the lead must only be deducted, while in other examples, the first rule alluded to is correct. This diversity is due to the length of the eccentric rods, and locality of the valve and gear, &c., allusion will now be made to each portion *seriatim.*

The mode of setting out the steam ports has often been a mystery to the many and thus known only to the few. There is, however, no just cause for this inequality of information; there is no reason why the fitter, who lines out the ports on the cylinder facing, or that for the valve, should not clearly understand the cause and effect. Let it be supposed an engine is to be constructed, and the lap of the valve given, to cut off a given portion of the stroke; in most cases the fitter engaged thereon, or even, perhaps, the foreman, does not understand the reason, or rather natural cause, for the dimensions to be adhered to. Now, were this matter more often considered and the practical observer initiated into the simplicity (not

mystery) of the action of the slide valve, doubtless a general improvement would be the result.

Presuming that there are a few who may be ignorant of the true proportion of the ports in the cylinder, and the action of the slide valve on the same, therefore, a concise explanation will not be out of place. The ports in the cylinder are for two purposes—supply and exhausting the steam. Now it is obvious that the pressure of the steam, on entering the cylinder, is greater than when exhausting therefrom. The proportion of the supply port to that for the exhaust is not a fixed sum or rule; as in all mechanical operations, circumstances alter cases—suffice it to say that in the case of the ports the same must be observed.

The area of the cylinder is the first consideration that engrosses the attention of the designer. Now it may be said that there should be a fixed rule for this, but practice teaches that the pressure of the steam should be considered. Many high-pressure engines greatly differ in the diameter of the cylinders, area of the steam ports, &c. The cause for this variation is the different ideas on the subject. In some instances the 12-horse power in one county is only ten in the next, and *vice versa*.