MACHINE DESIGN. PART I: KINEMATICS OF MACHINERY

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MACHINE DESIGN.

PART I.

KINEMATICS OF MACHINERY.

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PREFACE.

In these notes an attempt is made, first, to give, as clearly and concisely as possible, the principles of mechanical motion in such a manner that their application can readily be made to any mechanism for determining the motion of any of its parts; then to show the methods of dealing with such problems as the designer meets daily. Long and tedious discussions have been avoided as far as possible, it is hoped, fully.

Subjects such as toothed gearing and couplings are taken up only to the extent of the forms that are in the most common use. But with these subjects, as well as all others, references to what are believed to be the best works in their lines are given frequently.

All available works on the subject have been freely consulted, but in no case has any matter which has not become common property by its frequent publication been used without the consent of its author.

The exceedingly clear and concise work of Prof. Albert W. Smith, of Stanford University, entitled "Machine Design," has been of most valuable assistance throughout. This work includes both kinematics and mechanics. To Prof. Smith, especially, the writer would acknowledge his obligations and express his thanks.

FORREST R. JONES.

MADISON, WIS., November, 1897.

CONTENTS.

CHAPTER I.

CHAPTER II.

KINEMATICS OF MACHINERY.

CHAPTER I.

GENERAL PRINCIPLES AND DEFINITIONS.

MOTION OF A BODY.

1. When a body moves, there must always be another body with regard to which the motion occurs. Sometimes the statement that the movement takes place is all that is necessary to define it, the conditions being such that the reference body is clearly implied; but at other times a more specific statement is required. A simple example will illustrate: When a boat is running through the water at the rate of 12 miles an hour against a current of 3 miles an hour, the motion is clearly 12 miles an hour relatively to the water; but when referred to the land it is $12 - 3 = 9$ miles an hour.

The wheel of a locomotive furnishes another example: As the locomotive passes along the track, the wheel simply rotates with regard to the frame of the engine; but when referred to the track, the motion is a combined one of rotation and translation.

An examination of the motion of the piston shows a somewhat similar case: Relatively to the locomotive, the motion is reciprocating, its path being back and forth from end to end of the cylinder; but the motion is always forward with regard to the track when the locomotive moves forward, and *vice versa*.

A body entirely free to move may have motion in any direction according to the influences brought to bear upon it. In order for the motion to be a useful one, it must be constrained to such an extent that it will fulfil its required functions.