

**GOVERNORS AND  
THE GOVERNING  
OF PRIME MOVERS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649596058

Governors and the Governing of Prime Movers by W. Trinks

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**W. TRINKS**

**GOVERNORS AND  
THE GOVERNING  
OF PRIME MOVERS**



# GOVERNORS AND THE GOVERNING OF PRIME MOVERS

BY

**W. TRINKS, M.E.**

PROFESSOR OF MECHANICAL ENGINEERING, CARNEGIE  
INSTITUTE OF TECHNOLOGY, PITTSBURGH, PA.

*140 Illustrations*



UNIVERSITY OF  
CALIFORNIA

NEW YORK  
D. VAN NOSTRAND COMPANY  
25 PARK PLACE  
1919

TJ550  
T7

COPYRIGHT, 1919  
BY D. VAN NOSTRAND COMPANY

TO MR. VAN NOSTRAND  
AT NEW YORK

THE FLIMPTON PRESS  
NORWOOD, MASS., U.S.A.

## PREFACE

GOVERNORS have been the play toy of inventors for over a century, and have been the hobby of mathematicians for over thirty years. In spite of these facts, the knowledge of governors and of governing among both designing and operating engineers is very incomplete. There are several reasons for this condition. One of them is that governors do not cover a wide enough field to warrant a separate course in any engineering school. Instruction in governors is given in a scattered fashion. In courses in steam engineering, governors for steam engines and turbines are taken up. In courses on hydraulic motors, some time is spent on governors and governing; and the same is true of governors for internal combustion engines. Textbooks on prime movers reveal the same condition of affairs. Everywhere that which is apparent on the surface is reprinted, but nowhere (with very few exceptions) does the investigation go below the surface.

The present book aims to fill this gap. As far as I am aware, there exists to-day no other book of any consequence on governors and governing in the English language. There are books in French, German, and Swedish, but they are of little use to English-speaking engineers.

The present volume is a book of essentials and principles. Practice changes; there are fashions in engineering almost as changeable as those in women's clothes; but engineering principles do not change. For that reason, I have tried to dig out that which is essential, and to present it in such a manner that the reader is put in a position to judge existing and future types of governors as well as the properties of prime movers with regard to regulation. In consequence, the book contains not a single catalogue picture. Every drawing was especially prepared to show in a diagrammatic manner that which is important, with the intentional omission of everything else.

The book contains more than I give my students in the

classroom. Students, as a rule, do not know what their life-work will be in later years. While in school, they can be given only the "meat of the essentials." They are, however, anxious to know of a source out of which they can fill the gaps which their necessarily brief instruction at school has left. Nevertheless, the book by no means covers the whole subject of governing of prime movers. Many extremely interesting subjects were omitted, for two reasons: First, it was necessary to keep the price of the book within such limits as not to make its purchase a burden. Second, it was desirable to restrict the mathematical side of the book to a level which undergraduates can master, so that the reader may be spared the troubles of intellectual indigestion.

It is, however, planned to follow this book, later on, with another one on the subjects of "dynamics and design of modern governors for prime movers," which will be primarily intended for those engineers who make governors and governing a life study. In that book many subjects can be taken up which are clearly beyond the limits of the present volume. The foot-notes referring back to the preface indicate some of the subjects which are to be taken up in that volume. In addition, the other book will take up the effect of water inertia in hydraulic turbines and the governing of prime movers driving alternators in parallel. The present book was started in the spring of 1913. Lack of spare time and necessity for original work in the preparation of this book have delayed its completion until now. By the term "original work" I mean that practically all of the theories advanced by me were tried out practically. Some of the tests were made in the Mechanical Engineering Laboratory of the Carnegie Institute of Technology, but most of the trials were made in the field, in the attempt to help those who had trouble with regulation.

College graduates will have no trouble with the mathematical part. Operating engineers who have not had the good fortune of college training should likewise have no trouble, if they turn to the elementary derivations given in the appendix. By comparison, they will realize that the differential calculus is a wonderful short-cut.



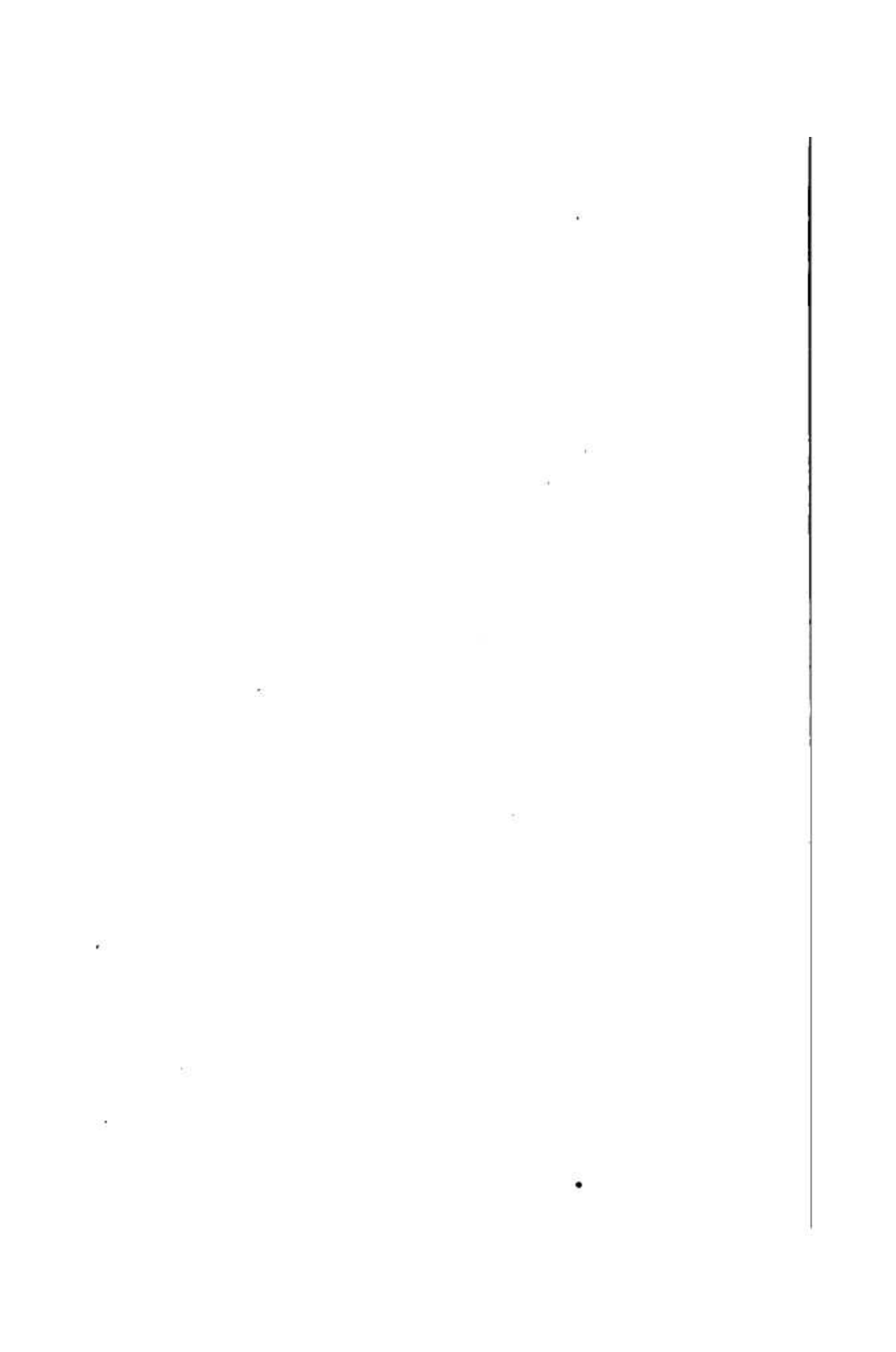
Like other books dealing with a specialty of applied mechanics, the present book must contain, for some readers, much that is known, and must occasionally pass over the heads of others. It is impossible to pitch the scale right for everybody.

The bookmark, containing all symbols, will, I hope, be of assistance.

For those who wish to go more deeply into the subject of governing, and who have library facilities, the bibliography will be valuable. It was prepared by the Carnegie Library of Pittsburgh. The librarians worked faithfully on this task. I herewith thank them for their coöperation.

W. TRINKS

PITTSBURGH, MAY, 1919.



## CONTENTS

	PAGE
PREFACE.....	v
LIST OF SYMBOLS.....	xiii
INTRODUCTION.....	xv

### CHAPTER I

GENERAL STATEMENTS.....	1
1. Purposes of Governors.....	1
2. Forces Used in Governing.....	2

### CHAPTER II

THE DIRECT-CONTROL GOVERNOR AS A MOTOR.....	4
1. Strength of Centrifugal Governors.....	4
2. Regulating Force of Tangential Inertia.....	8
3. Work Capacity of Centrifugal Governors.....	14
4. Detention by Friction.....	15
5. Overcoming a Passive Resistance.....	19

### CHAPTER III

THE CENTRIFUGAL GOVERNOR AS A MEASURING INSTRUMENT (SPEED COUNTER).....	23
1. Equilibrium Speed, Static Fluctuation, Stability.....	23
2. Characteristic Curves.....	25
3. Constituent Parts of Characteristics.....	34
4. Influence of Shape of Centrifugal Weights.....	40

### CHAPTER IV

PROMPTNESS AND TRAVERSING TIME.....	45
-------------------------------------	----

### CHAPTER V

ADJUSTMENT OF EQUILIBRIUM SPEED.....	49
--------------------------------------	----