

THE HUMAN MACHINE AND INDUSTRIAL EFFICIENCY

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The Human Machine and Industrial Efficiency by Frederic S. Lee

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FREDERIC S. LEE

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AND INDUSTRIAL
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WITH ILLUSTRATIONS

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PREFACE

MOST of the substance of this little book constituted the two Cutter Lectures on Preventive Medicine and Hygiene, which were given at the Harvard Medical School, April 25 and 26, 1918, under the title "Industrial Efficiency and the War." Many of the facts here presented relate to war industries, but they are none the less pertinent as illustrating the principles enunciated; and even if interest in the facts dies out, the principles, it is hoped, will survive and receive attention long after the war has ended. I believe fully that any activity in which the human body plays so large a part as it does in industry must be organized on a physiological basis before the highest degree of efficiency can be secured. In the field of human activity here discussed a science of industrial physiology must come into being, a science of the human machine in industry, and this must be developed largely within industrial establishments themselves. They constitute the laboratories in which much of the observation and experiment of the future must be made. If I can help to make this thought accepted by others than

physiologists and especially by industrial leaders, I shall be gratified.

In preparing this summary of our present knowledge I am under many obligations to my colleagues in the U. S. Public Health Service and the Committees on Industrial Fatigue. Their names will be found at the beginning of the Bibliography printed at the end of the volume. The numbers in the text refer to the Bibliography.

FREDERIC S. LEE.

COLUMBIA UNIVERSITY,
June 1, 1918.

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THE HUMAN MACHINE

I

INTRODUCTION

IN the modern factory the science of machinery is developed to its highest point. In the selection, construction, and use of the machine nothing is left to chance. Its type is selected in accordance with its exact fitness for the work demanded of it. It is constructed of appropriate materials and is so designed as to avoid lost motion and the waste of energy involved and to allow the highest possible proportion of the total energy that is transformed to perform the work required. It is kept clean, unnecessary friction is avoided, and every care is taken that its bearings shall not become corroded, rusted, or worn beyond repair. When in action it is run at a speed for which it is planned, it is not overloaded, and not overheated; the conditions under which it can work with the greatest efficiency have been carefully studied; and every effort is made to maintain these conditions and secure the largest possible output with-