

# INDUSTRIAL HEALTH

*An Introduction for Students*

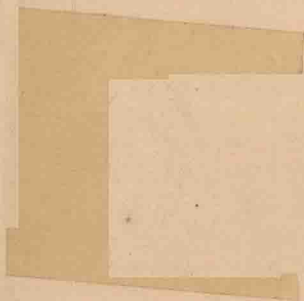
BY

R. PASSMORE

AND

CATHERINE N. SWANSTON

With a Foreword by  
Professor F. A. E. CREW



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R. PASSMORE

M.A., D.M., F.R.S.E.

*Lecturer in Physiology, Department of Public Health  
and Social Medicine, University of Edinburgh.*

AND

CATHERINE N. SWANSTON

M.R.C.S., L.R.C.P., D.P.H., D.I.H.

*Lecturer in Industrial Health, Department of Public Health  
and Social Medicine, University of Edinburgh.*

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## PREFACE

It is one of the paradoxes of history that, during the last two hundred and fifty years, despite the great developments in the uses of power and in the design and manufacture of labour-saving devices, there has been no apparent falling off in the amount of work that it is necessary for men to perform. No system of society has as yet delivered any but a small minority of its members from the necessity of daily toil. Work remains the principal component of daily life for the overwhelming majority. But with the new methods of work and their infinite complexities, new hazards have arisen. There are now innumerable ways in which health can be impaired by adverse factors arising at work. But with the increased risks, there has also arisen increased knowledge. We have now accumulated a vast body of technical knowledge, which may help us in so organising working conditions that no man's health need suffer from the nature of the work that he does. The application of a little of this knowledge is enforced by legal enactment and statute; more is applied by the enlightened opinion of management and workers but, unfortunately, much remains unused. In all industrial countries to-day, much ill-health arises from conditions of work which could be prevented by the use of knowledge already won by investigators in factories, workshops and laboratories.

In this book we attempt to make a brief statement of the rules of industrial hygiene. In most respects these are based on simple and straightforward principles of human physiology and psychology. A small book of this nature can only state main principles. Many reference

works already exist dealing with the innumerable problems of detail which may arise under the varied conditions of modern industry. As University teachers, we write primarily for our own students, whom we wish to spare the task of note-taking at lectures. Undergraduates in the faculties of medicine, arts, science or law, who plan a career connected in any way with industry, will find here information and ideas relevant to their future work. But we hope that it will be found useful by others such as personnel officers, works managers, Trade Union leaders, industrial nurses and indeed all those whose task it is to see that a particular factory or workshop is a fit place for men and women to spend a third of each working day.

## FOREWORD

My colleagues, in inviting me to contribute a foreword to this book, do me honour. They also, perhaps unwittingly, add to the strength of their teaching, for they make it manifest that the quality of their product, the outcome of their work, is largely determined by the degree of harmony that exists in the place where the work is done and among the group of which the workers are members.

For most people of an urbanised, industrialised country like ours work has come to mean the exchange of energy, ability, aptitude and skill for a wage which can be translated into commodities for the satisfaction of our need and into opportunity for the satisfaction of desire. It is true that to very many people work means much more than this. Striving to be good citizens, they desire to contribute to the common weal and in their work they find the opportunity for doing so. To them work is a social duty and part of the wage is the satisfaction that comes from duty done. It is easier to entertain this view when the work that is done is congenial. But of work there are many forms, and to a particular individual not all are equally attractive. As things are, many an individual is forced by circumstances beyond his control to engage in work that to him is positively distasteful.

My colleagues and I are to be numbered among the fortunate, for we work, and work hard, in jobs of our own choosing. From our work we get the means with which to satisfy our needs and wants, but we are also permitted to think that what we do is contributive to the common weal and, moreover, we derive from our work a very deep and abiding satisfaction. It is with understanding and sympathy that we, who are so favoured, attempt in various ways to help those who do not share our good fortune. This book is a gesture of this understanding and sympathy.

Its authors seek to attract the attention of those who, directly or indirectly, are concerned with work and the worker. And who is not? Through its pages runs the

theme that the true value to society of a particular form of work is not to be judged by the monetary value of its product, not by the comfort and convenience that this product yields to the user, but by the effects which the kind of work and the conditions of work have upon the workers. The worker is more than one who works, he is a human being, a member of a family, a member of the larger community, and the effects upon him of the nature and the place of work largely mould him and fashion his philosophy.

There are trades recognised by the law to be dangerous. But in the sum these are far less hazardous than are the uncongenial and those which stifle the creative urge. When sickness rates, accident rates and absenteeism are exceptionally high in a particular form of industry then it becomes highly probable that much of this is dramatised discontent and that that particular form of work is, by its nature or because of the conditions which attend it, itself disease-provoking. Since one of the main social functions of Medicine is to prevent and to control the action of disease-provoking agencies it follows that this is a matter which attracts the attention of the medical scientist.

Science in application is misused if as a result man does not enjoy fuller opportunities for the attainment of greater dignity. The main function of Science in relation to Industry is not to facilitate the production of more and more ingenious things but to reduce to a minimum the number of jobs that cannot give intellectual and emotional satisfaction to the workers and so to fashion the rest that from them he can receive a real wage, augmented health and increased happiness.

F. A. E. CREW.

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## CHAPTER I.

### THE WORKING POPULATION

*Distribution of manpower in Great Britain, the principal industries, location of industries, employment of women, young persons and old people.*

#### Distribution of Manpower

In Great Britain, twenty-three million men and women work for their living, earning their daily bread by manual labour or intellectual activity. This is nearly half the total population, so that each individual has, on an average, the responsibility for the economic support of one other person besides himself. There are also about nine and a half million housewives who earn no income. High taxation during the last thirty years has re-distributed the national wealth and left few people with unearned incomes sufficient for their needs. The man of independent means is rapidly disappearing. The great extremes of wealth and poverty, so common fifty years ago, no longer exist; many people are less wealthy and, with the levelling of incomes and the increase of social services, the poorer members of the community have achieved a higher standard of living for themselves and their families.

One result of the reduction of personal wealth among the middle and upper classes has been the increased employment of women. Fathers can no longer afford to keep their daughters in idleness until they marry, and wives, who wish to earn their own pin-money or who need to augment the family income, have sought employment

on their own account. The working woman is to be found in all walks of life and in most occupations. War, twice in a generation, has brought the debutante and her domestic to the same factory bench. Opportunities, seldom found in times of peace, have been made for the man at the bottom of the ladder to climb quickly to the top.

Our twenty-three million workers are scattered through many trades and employments, and include those serving with the armed forces, those in industry, those on the land, those in professions and the registered unemployed. Table I shews the distribution of the working population in August 1949.

The present industrial pattern is influenced by the country's need to repair the ravages of war and to build up export trade. Many of the most important and basic industries are short of workers and the Control of Engagement Order\* has been used to guide those seeking work into the essential industries. In 1948, over half a million people were so placed. At present (1949), the two industries still seriously short of labour are coalmining, which requires 10,000 more men, and textiles, where 24,000 workers are needed. These must be either found in the unemployed group, taken from less important industries, or recruited from foreign countries. The unemployed (at present 265,000) include those genuinely out of work and seeking jobs, those temporarily "stood off" or in transfer from one job to another and a certain number of "unemployables," who, for one reason or another, are incapable of holding down steady work.

\*Under this Order of 1947, all men aged 18 to 50 and all women aged 18 to 40 must obtain work through the recognised agencies. For most applicants, these are the Employment Exchanges of the Ministry of Labour.

TABLE I  
DISTRIBUTION OF MANPOWER IN GREAT BRITAIN  
AUGUST 1949\*

	<i>Thousands</i>
Total Working Population ... ..	23,253
Armed Forces (including leave) ... ..	776
Coalmining ... ..	779
Other Mining and Quarrying ... ..	82
Gas, Electricity and Water ... ..	311
Transport and Communication ... ..	1,815
Agriculture ... ..	1,234
Fishing ... ..	41
Manufactures ... ..	8,282
Building and Contracting ... ..	1,490
Distributive Trades ... ..	2,789
Professional, Financial and Miscellaneous Services ... ..	3,924
National Government Service ... ..	683
Local Government Service ... ..	782
Total in Civil Employment ... ..	22,212
Unemployed ... ..	265

\*Figures extracted from Ministry of Labour Gazette for October 1949.

### The Basic Industries and Services

These are: (1) mining and quarrying, (2) gas, electricity and water, (3) transport and communication, (4) agriculture and fishing. On these, the country depends for its food, the rest of its industrial and manufacturing activities and much of its daily life. Without coal, there would be no steam, gas or electricity; without water, there would be no sanitation or drainage; without fishing and agriculture, no food; without quarrying, little building;

and without transport and communications, our complicated economic life would stop. These industries serve industry. They move the machinery, light the workshops,



FIG. 1

Principal coal fields in Great Britain.

bring raw materials to the factories and distribute the finished goods.

### **The Location of Industries**

During the past two hundred years the population of Great Britain has increased six-fold. It has also been redistributed so that areas which were sparsely inhabited are now densely populated and others are now deserted which formerly supported large communities. This new

deployment of the population has resulted from the development of industry and the relative decline in agriculture. The location of the industrial areas has been



FIG. 2

Areas with population density over 500 persons per square mile

influenced by the need for coal and access to seaports. We live in an island and have no lack of ports. We have rich coalfields and are fortunate that many of these lie near the coast.

The chief industrial areas in Great Britain are in South Wales, the Midlands, North-East and North-West England, Lanarkshire and London. All but the last lie in the coal belts and most of them have easy access to seaports.

Figures 1 and 2 shew maps of Britain marked with the coalfields and industrial areas.

Before James Watt, in 1781, adapted the steam engine, the only mechanical power available to industry was water-power. Consequently, the early factories were built near streams and rivers, often far from the villages where the workers lived. The use of steam led to the building of factories near coalfields and it was convenient to place them nearer the homes of the people, who were wanted in ever increasing numbers in the workshops. The industrial cities of to-day, with their slums and their overcrowding of factories and houses, are a legacy from the unplanned and unrestricted building of the nineteenth century.

### **The Working Groups**

Although the adult male in the prime of life is generally the most efficient worker, there are certain jobs for which he is not particularly suited and, further, there are insufficient men in their prime to do all the industrial work needed. For these and other reasons, young persons, women and old people are employed in industry in large numbers. We will now consider a few of the special problems presented by these working groups.

### **The Employment of Women**

Women form less than one third of all industrial workers. Figure 3 shews the sex ratio of certain occupational groups employing in all nearly fourteen million persons. In the basic industries of mining and quarrying, supply services, transport and communications, where much of the work is heavy and shift work is common, very few women are found (6.3% of all workers). In building and contracting, there are even fewer, and in the heavy metal and chemical trades they comprise less

than one fifth of the labour force. They form just under a third of workers in all other manufacturies and nearly one half in the distributive trades—most of them in this group being shop assistants.

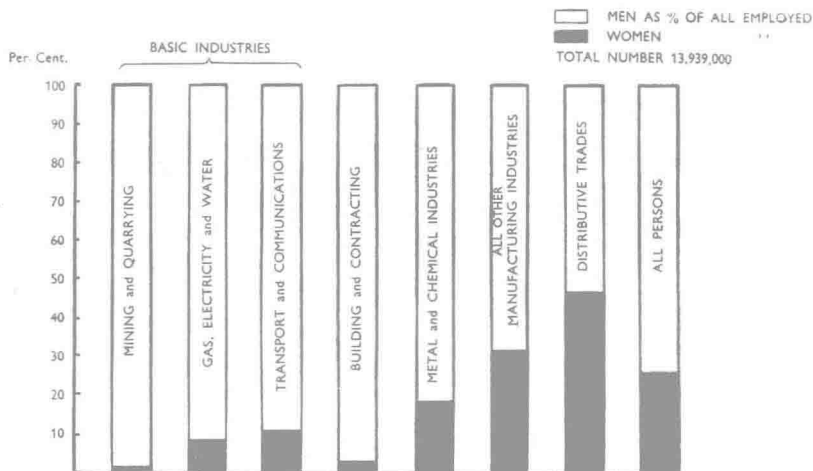


FIG. 3

Distribution of men and women in industrial employment in August, 1949.

In some occupations women predominate. Since pre-historic times, spinning and weaving have been women's work and remain predominantly so despite the introduction of machinery at the industrial revolution. The clothing industry also employs many more women than men.

With a few exceptions, women are found chiefly in those occupations where the work does not require great skill or sustained physical exertion. Women do not usually work in extremes of temperature or with dangerous machinery or during abnormal shifts. Two factors influence the choice of occupation for a woman. In the first place, most girls entering industry look upon their

job as a temporary expedient until they marry, therefore they are not likely to enter a skilled trade which requires a long apprenticeship. Employers are reluctant to apprentice girls to a long and costly training when there is little prospect of their remaining long enough to be of real service to the firm. This is one reason why girls are employed largely on unskilled or semi-skilled work and, even if they continue at their jobs after marriage, their lack of training precludes their employment in the skilled occupations. The second factor is the relatively poor physical capacity of women due largely to their inferior muscular development. Women, are on the average, shorter in stature than men, lighter in weight, and their arm and finger spans are less. Their average strength, as shewn by carrying weights or pushing and pulling loads, is little more than half that of a man's, and their breathing capacity is less. Table 2 shews a comparison of the physical measurements of women and men.

TABLE 2  
COMPARISON OF PHYSICAL MEASUREMENTS  
OF MEN AND WOMEN\*

	<i>Men</i>	<i>Women</i>
Stature (inches) ... ..	67.9	63.3
Height, sitting (inches) ... ..	36.0	33.9
Span (inches) ... ..	69.9	63.0
Breathing Capacity (cu. inches)	219.0	138.0
Strength of Pull (pounds) ...	74.0	40.0
Squeeze (strongest hand, pounds)	85.0	52.0
Swiftiness of Blow (ft. per sec.) ...	18.1	13.4

\*E. P. Cathcart "The Physique of Women in Industry," 1927.  
Med. Res. Coun. Indust. Fat. Res. Board Report No. 44.



From some occupations women are excluded by law. No woman or girl may work underground in any mine or colliery, nor in certain processes connected with the extraction and processing of lead. Because they are not permitted to work at night, many occupations are closed to them, and custom and expediency debar them from others. Nevertheless, that women can do much of the work normally undertaken by men has been demonstrated during the two Great Wars.

### **The Employment of Young Persons**

Young people are to be found in every trade though they are excluded, on grounds of health or safety, from certain dangerous processes. In law, a "young person" in industry is one who has left school but has not yet reached his or her eighteenth birthday. Young persons and women together form a group known as "Protected Persons" because industrial protective legislation is extended primarily towards them.

The number of young people working in industry is decreasing yearly and they now form a much smaller proportion of total workers than in former days. In 1847, 36 per cent. of all textile workers were under eighteen years of age; a hundred years later this figure had dropped to 3 per cent.

Table 3 shews the decline in industrial youth of the last decade. Since 1937 there has been a drop of 600,000 boys and 300,000 girls. The chief reasons for this decline over the last century have been the establishment of compulsory education and the progressive raising of the school-leaving age.