

Industrial Cleaning Technology

Joe Harrington



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Edited by

Joe Harrington

PCT, Durham, United Kingdom



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INDUSTRIAL CLEANING TECHNOLOGY

Dedication

I dedicate this book to my wife Barbara, my two sons Mark and Neil, his wife Linda and my three grandchildren, Matthew, Michael and Rachel.

Preface

The word cleaning covers a wide range of activities from good housekeeping and janitorial duties to clinical process cleaning applications that form part of our everyday lives, most people are not aware of their existence, and yet without them, many of the services and products we take for granted would not be available. Most chapters include case studies of various cleaning problems together with the solutions offered.

Emphasis is placed on the practical aspects of designing, manufacturing and operating cleaning equipment, this includes a detailed examination of traditional cleaning methods, and considers a number of lesser known techniques that have been developed over recent years together with a glimpse of the future trends in the industry

In addition to the actual cleaning techniques, the book examines the effect, of increasing international health, safety, training, and environmental legislation together with regulations that control cleaning standards in the pharmaceuticals, cosmetics, food and drinks manufacturing industries. In this respect, the book is not intended to be a definitive reference book. Legislation and regulations are continually being upgraded, particularly those relating to European Directives. No apologies are given for the fact that the reader will be continually reminded of the need to obtain up to date copies of the various documents referred to, and to secure expert advice on those issues that are crucial in terms of health, safety and hazardous conditions. To assist the reader, useful information sources are listed in the reference section following each chapter.

The cleaning applications discussed in the book, and possible solutions, can be found in all parts of the world. Similarly, the importance of health, safety and training programmes, is just as important in developing as developed countries.

The book will be of particular interest to manufacturing, maintenance, process, design engineers and managers, purchasing officers, safety managers, municipal service personnel, manufacturers of cleaning equipment and systems, government and defence technologists, contracting officers, university and technical college lecturers, engineering students and companies involved in all aspects of contract cleaning work.

Performance figures and other data, are offered in good faith, but do not constitute a guarantee. The author makes no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility or liability for any errors or omissions that may be made. Details of the products mentioned are given completely free of undertaking, since their application is within the control of the user.

Acknowledgements.

Although my career has changed direction on a number of occasions, from a senior engineer officer with the Cunard Steam Ship Company to a manufacturing manager in charge of an international domestic appliance factory, engineering has always played an important part in my life. My first contact with cleaning technology happened 22 years ago, when I became sales director of a high pressure pump manufacturing company. This involved visits to many parts of the World and introduced me to a technology, using high pressure water, that completed out in hours, tasks that had originally taken days. Since this time, with my own company Process Cleaning Technology, I have been involved in all types of cleaning techniques from low to ultra high pressure in a wide range of industries. This book is very much based on those 22 years of hard experience. In more recent years, the cleaning industry has been affected by the introduction of numerous regulations and legislation, to the point at which engineering knowledge alone is not sufficient. I hope the book can provide some assistance to those individuals faced with making difficult technical decisions concerning cleaning applications, where information is very limited. In this respect, I have attempted to include material that I hope will be of practical value.

Most of the technical material has been supplied by companies and individuals with whom I have dealt with over the years. Specific acknowledgements are given in each of the chapters. However, I would like to thank, in particular:

Don Whitehead. CDN Systems. Darlington England. A highly respected engineer in the cleaning industry, a very good friend and business colleague over the last 22 years.

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Dr. Anthony Luke. Principal Officer (Environmental Protection) Middlesbrough Borough Council. England.

Last but not least, my wife Barbara, for her patience and the hundreds of cups of coffee that kept me going during many long hours spent on my computer. Also my son Mark for assisting me with my computer problems, proof reading and the inevitable sorting and checking work involved.

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INDUSTRIAL CLEANING TECHNOLOGY

JOE HARRINGTON

1 Introduction to industrial cleaning technology

1.1 Those early days

Cleaning has been part of manufacturing processes for centuries, industries, such as textile, woollen mills and breweries, have traditionally used water for washing purposes.

The introduction of modern cleaning technology can be closely linked to the development of pumps and spraying equipment. Until the 19th century ‘Industrial Revolution’ the only power available, apart from human power, was provided by animals, wind and gravity. Steam then became the main source of energy to drive pumps in order to provide the higher pressures and flow rates required by the chemical, iron, steel and engineering industries. Municipal authorities were also faced with increasing demands for improved domestic water supplies. At this time the maximum water pressures were of the order of 100 to 200 psi. A typical high pressure steam driven pump used for boiler feed duties, is illustrated in *Figure 1.1*. This pump together with a two cylinder 140 hp beam pumping engine, two Lancashire boilers, a 220 hp Hornsby – Stockport anthracite gas engine and many other examples of late 19th and early 20th century engineering archaeology were installed at the Tees Cottage pumping station, Darlington, England (1) and have been restored and are used for ‘open day’ demonstrations

With the turn of the century, the introduction of pumps driven by ‘town gas’ provided an improved energy source, followed by a new generation of electrically powered pumps capable of producing high pressures and flow rates. An example is shown in *Figure 1.2*.

1.1.1 John Bean and the FMC company (2)

Perhaps the story of John Bean, in the USA typifies the pioneering spirit of the 19th century American technological entrepreneurs. John was born in Maine in 1821. He was a prolific inventor of pumps and spraying systems, by the time he was 30, he had achieved a national reputation as the inventor of the first double-acting force pump for oil wells. This was followed by the well known ‘Buckeye Force Pump’, the first deep well pump of which thousands were sold. Prior to Beans’ invention, pumps were extremely inefficient with limited capacity. John also completely redesigned existing pumps to form, what became, the famous ‘continuous flow turbine’ which is still in use today.

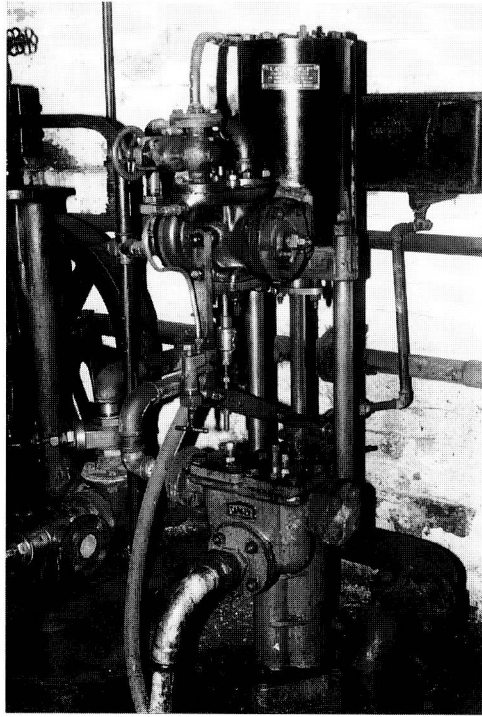


Figure 1.1 Steam driven boiler feed pump manufactured by the Weir company of Glasgow in 1904. (Courtesy of the Tees Cottage Preservation Society)

Following several business and health problems in the late 1880s, 'Bean' enlisted the help of his grandson, John Crummey, who had recently graduated from Stamford University. The young 'Crummey' had inherited the 'Bean' family work ethic and succeeded in developing the family business, purchasing the Bean Spray Company in 1901. The new company grew from strength to strength, and marketed the first spray pump to achieve 120 psi. *Figure 1.3* shows John with one of his original spray pumps. John Bean was still working on new inventions until his death in 1909. By 1915, the Bean company had established a national reputation with a powered mobile pump named 'The Bean Giant Power Sprayer' driven by a 2.5 hp Fairbanks-Morse engine. It had a capacity of 9 US gpm and a pressure of 250 psi, a significant advance on any other spray pump available at that time. The product won first prize for the best power sprayer at the 1915 Panama-Pacific Exposition in San Francisco.

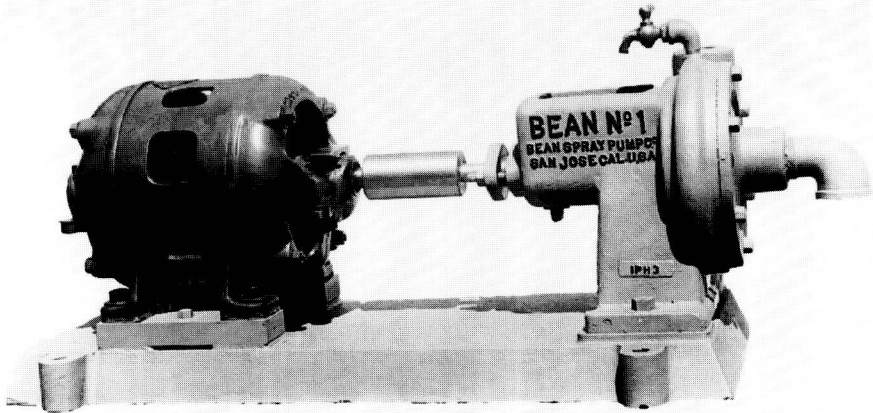


Figure 1.2 Early 20th century electrically powered spray pump, manufactured by the John Bean Company (courtesy of the FMC Corporation Chicago)

Over the following years, the company expanded through increased sales, the acquisition of a foundry and engine manufacturing company. One interesting development was the installation of the 'Bean high pressure car wash system' one of the first in the world, shown in *Figure 1.4*. John Crummey succeeded as ¹ of the company on the death of his father in 1928. One year later, the John Bean Manufacturing Company name was changed to Food Machinery Corporation, a name that decades later would become internationally recognised as FMC, a major manufacturer of chemicals, engineering and agricultural equipment. A far cry from the humble Bean Spray Company founded in 1888.

John Crummey died in 1976 at the age of 98, he had been associated with The John Bean Manufacturing Company and FMC for 75 years. A legend in his time.

1.1.2 High pressure pump and equipment companies

During the late 19th century, a number of specialist pump manufacturing companies were established in Europe, particularly in Great Britain and Germany, many are still operating today. Most of the pumps manufactured in the early part of the 20th century were designed for hydraulic, process and crop spraying applications. It was not until after the second World War, that the value of high pressure water as a cleaning medium was recognised. Perhaps Germany should be credited with the greatest contribution to early cleaning technology, with famous pioneers such as Paul Hammelmann (*Figure 1.5*), who set up his high pressure pump company in the early 1950s. One of their earlier mobile pump units, manufactured in 1965, is illustrated in *Figure 1.6* together with a cleaning tank, *Figure 1.7*, used for removing the cores from castings.



Figure 1.3 John Bean with his original spray pump
(courtesy of the FMC Corporation Chicago)

In 1962 another German, Wolfgang Maasberg, founded the well known Woma Apparatebau company, followed by URACA Pumpenfabrik, based near Stuttgart, well known manufacturers of high pressure plunger pumps since the late 19th century. URACA entered the cleaning market with a new range of pumps and accessories, in particular internal tank cleaning heads.

In the USA, a number of pump manufacturers, notably Haliburton, the Tritan Corporation, Butterworth and Aqua Dyne, developed high pressure pumps and accessories during the post World War 2 period, to cope with increasing demands from the chemical industry, petro-chemical plants, and oil refineries, whilst the Japanese company 'Sugino' enjoyed similar success in the Far East.

The UK. high pressure water cleaning equipment market expanded rapidly during the 1970s dominated by several pump companies, including: A.Long (Hydrojet), Babcock Kina, Aqua-Hydraulics, F.A Hughes, Neolith and the 'Harben' company; with their unique radial piston diaphragm pump, all enjoyed successful export sales markets, particularly to