

Chapter 4. Humanity, profit, and distress

People must work to eat

Chapter 3 quoted Charles Thackrah on control technology in his 1832 book, but, as we hinted there, he realised that “social principle” was also essential. When he looked round his city of Leeds, he could see how often it was missing. He was particularly exercised by the fate of children.

“No man of humanity can reflect without distress on the state of thousands of children, many from six or seven years of age, roused from their beds at an early hour, hurried to the mills, and kept there, with the interval of only 40 minutes, till a late hour at night; kept, moreover, in an atmosphere impure, not only as the air of a town, not only as defective in ventilation, but as loaded with noxious dust....Masters however enlightened and humane, are seldom aware, never fully aware of the injury to health and life which mills occasion. Acquainted far less with physiology than with political economy, their better feelings will be overcome by the opportunity of increasing profit, and they will reason themselves into the belief that the employment is by no means so unhealthy as some persons pretend, and that the children will be nothing the worse for two or three half-hours a-day more labour, and a little less time for meals...Time was thus saved; more work could be done; and the manufactured article consequently could be offered at a less price.”¹

We are used to thinking of “injury to health and life” almost in isolation from other employment problems, but for 19th century campaigners many problems were closely linked - exploitation of women and children at work, starvation wages, very long hours, bad housing and nutrition, and health and safety in the workplace. Children often had to work because their families could not otherwise afford to feed them, and the children knew this. The conditions under which people lived and worked are so beyond our experience that they are hard to imagine. Women put up with terrible conditions and exploitation because in many places there was no choice of employment. Thackrah estimated that “at least 450 persons die annually in the borough of Leeds, from the injurious effects of manufactories, the crowded state of population, and the consequent bad habits of life.” The corresponding number of early deaths for Great Britain he estimated at 50,000.

From the 1830s onwards, social campaigners woke consciences to threats to health in towns – the need for public hygiene – and conditions in factories and mines, especially in the employment of children and young women. A series of private reports and official commissions led slowly to a series of Acts of Parliament through the century. A landmark was the Factory Act 1833 “*to regulate the Labour of Children in the Mills and Factories...*” A later commission dealt with conditions in mines, and produced a report with moving illustrations that are still often reproduced. With difficulty, Lord Ashley (who later became Lord Shaftesbury) got a bill through Parliament to deal with the worst problems.

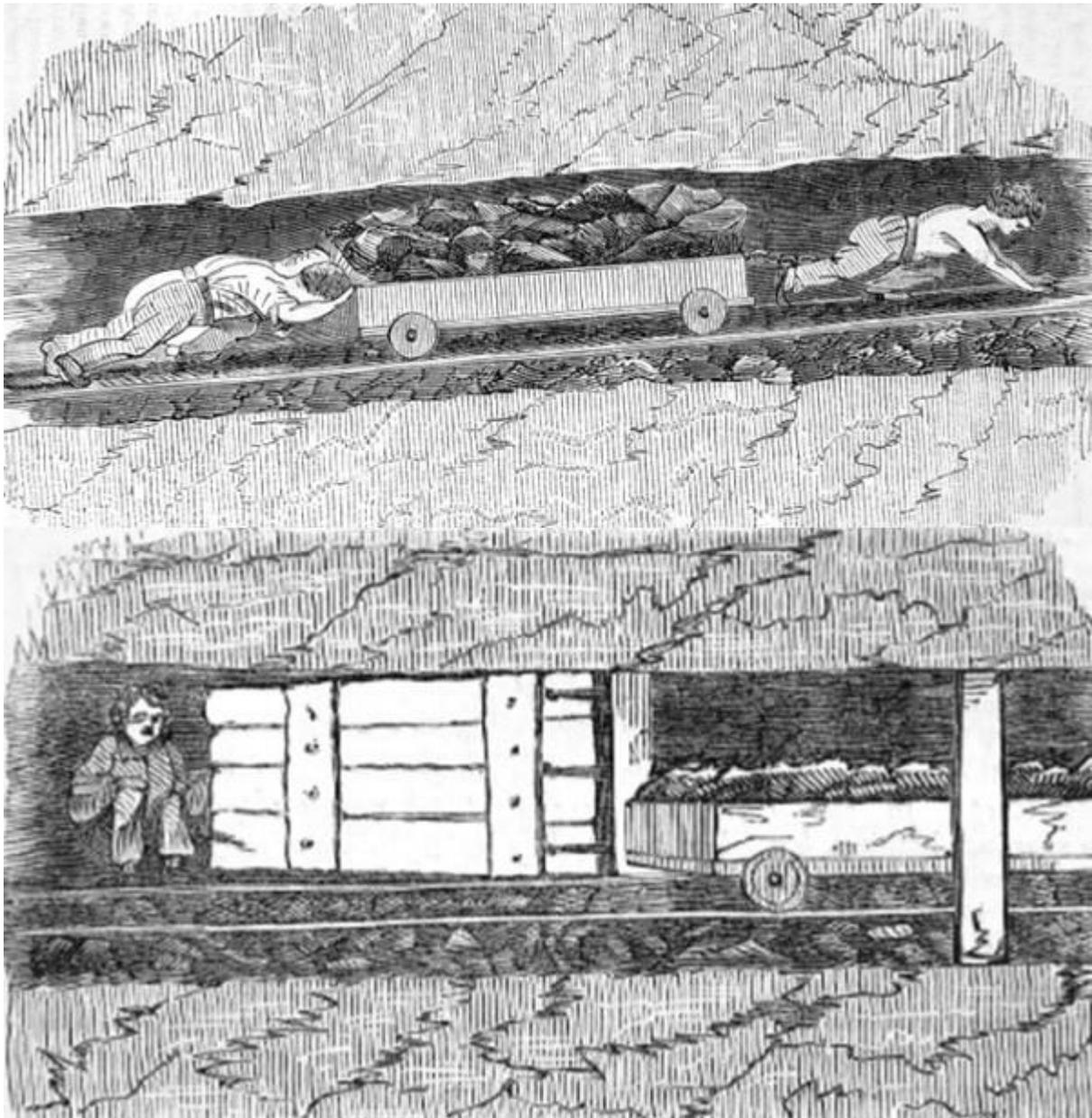


Fig. 4.1. Two of the illustrations from the 1842 report on children's conditions in mines. The older children might be employed in haulage, especially where the seams were narrow, with predictable effects on their physical development. In some ways the other employment illustrated is more horrifying. It could involve children of seven or younger. Their job was to sit by ventilation doors, and to listen for approaching coal carriages and open the doors. The report said that they could be left this way on their own in the dark day after day for 12 hours a day.² (Public Domain)

But people who had time to read were more likely to read novels than Parliamentary reports. Elizabeth Gaskell (1810-1875) married a Unitarian minister with a church in central Manchester, and was shocked at the condition of the poor that she met in the course of their work. In her 1854 novel *North and South* she wrote movingly about a 19-year-old middle-class woman who moves to a cotton city in the north of England, and befriends a mill girl of the same age who is dying of byssinosis. Mrs Gaskell deeply upset the cotton-mill owners in her husband's congregation. Charles Kingsley (1819-1875) was an Anglican clergyman whose radical views led to his being briefly banned from preaching in the diocese of London. His novel *The Water-Babies* (1863) featured Tom, one of the boys employed by sweeps to climb inside chimneys (not effectively banned until an Act proposed by Lord Shaftesbury in 1875). Even more famous, Charles Dickens (1812-1870) was familiar with conditions of the poor and their working lives from his early experiences, and the 1879 Chief Inspector's report quoted him for support.³

Then as now, it was one thing to pass Acts of Parliament, but so much depended on effective enforcement, which was in the hands of local magistrates until the 1833 Act allowed the appointment of four Factory Inspectors. This was increased to 38 in 1867 and 65 in 1885. They were clearly very thinly spread, and in any case many workplaces were outside the definition of "factory".

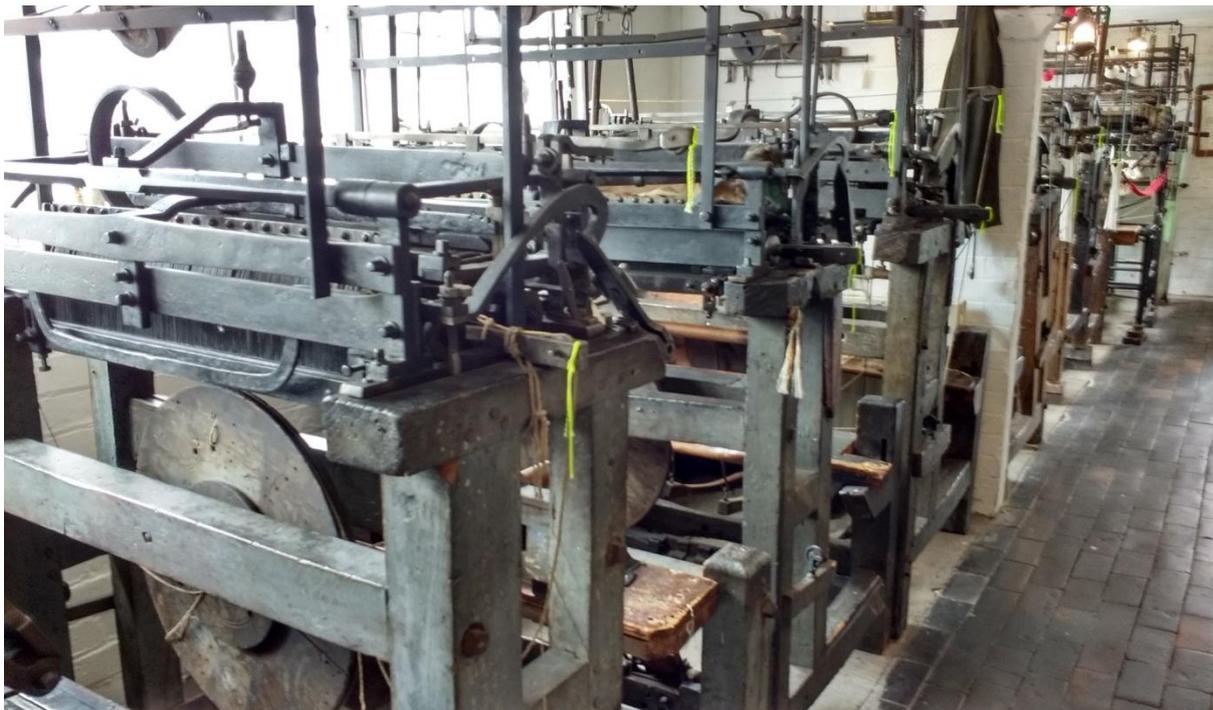


Fig..4.2. Knitting frames of an early 19th century type at the Framework Knitters Museum, Ruddington, Nottinghamshire. The operator would sit on the bench with his or her head close to the machine behind, and it is said that the knitters quickly became deaf. This row of frames would benefit from the light from the window. The operators of the frames on the other side of the walkway, out of view on the right, would not do so well, especially in winter. (Photo T Ogden, with thanks to the Museum: <https://www.frameworkknittersmuseum.org.uk/>.)

Action on child labour continued through the 1800s, and restrictions on hours were gradually increased for more and more industries and for wider definitions of young people. In 1878, the Chief Inspector of Factories, Alexander Redgrave, looked back to the start of the Inspectorate in 1833, and thought that some progress had been made. He wrote that in the early years of the Inspectorate

“Employers strenuously opposed reduced hours of work; parents claimed the labour of their children, seeking by every contrivance to evade the necessity of school attendance, and to pass their children off as older than they really were. The work of inspection therefore consisted in seeing that the hours of work were not exceeded; these were ordinarily from 6 a.m. to 6 p.m. or 7 p.m.: that the proper meal times were given: that children attended school regularly and were not employed at an illegal age: that the factories were duly limewashed, and subsequently that mill-gearing and machinery were well and securely fenced.”⁴

But clearly the problems remained huge. In his 1893 and 1894 reports, another Chief Inspector wrote of the “vast aggregation of people slavishly earning a a poor living from hard taskmasters”.

In 1891 a handful of Lady Inspectors of Factories were appointed, partly to deal with women working long hours with little pay for exploitative employers. For much of the time until they were united with the rest of the Factories Inspectorate in 1921, the Lady Inspectors were energetically led by Adelaide Anderson, who wrote a book about their work, *Women in the Factory*.⁵ She is the subject of recent biography, *Women and Children in the Factory*, by Anne Spurgeon⁶, and this gives an illuminating picture of the operation of the Inspectorate through that time, including how their work was affected by social and political attitudes, as well as industrial conditions. The attitudes included a widespread feeling that it was the responsibility of the workers to look after themselves, and it was not the job of employers to spend money to provide good environments. If it was argued that women needed special protection, this could be opposed by some supporters of women's rights, who opposed treating women differently from men.

What about hazardous agents?

Slowly, there was improvement, but to what extent was occupational hygiene part of this? In 1861 and 1862, reports by Sir John Simon, the Medical Officer of the Privy Council, said that deaths and mutilations from unfenced machinery “would probably count as nothing in comparison with those which the unventilatedness of factories occasions”, probably the first explicit statement of the overwhelming numerical importance of health compared with accidents.³ Following this, the 1864 Factory Act required that every factory should be “ventilated in such a manner as to render harmless, as far as is practicable, any gases, dust, or other impurities generated in the process of manufacture, that may be injurious to health”.⁷ The 1878 Factory Act included further measures to tackle the problem, with an emphasis on cleanliness and ventilation, permitting inspectors to require fans “or other mechanical means”, if “it appears to an inspector that such inhalation could be to a great extent prevented.”⁷ Cleanliness and ventilation were amongst the controls that Charles Thackrah had listed in 1832 (see Chapter 3), and they had the advantage that everyone could understand them and inspectors could easily see if they were applied.

Be clean or be poisoned?

The 1879 Chief Inspector's report illustrates how “cleanliness” could be a useful requirement even in the absence of quantitative measurement methods. The report gives an account of the inquest into the death of an unfortunate young girl in a London factory off the Clerkenwell Road, near the Faringdon railway cutting. This had been an area of notorious slums and small businesses doing unpleasant things with carcasses and waste from the nearby Smithfield Market, but the girl had a job

in a fairly new factory, and like many similar workers at that time she had evidently died of lead poisoning. She worked applying colours, and analysis of her apron found various compounds of lead, arsenic, chromic acid, antimony, and mercury. Wiping her hands on this could have contaminated rather than cleaned her hands. The inquest discussed prohibiting eating in the factory and of requiring the girls to wash their hands before leaving, measures that could readily be enforced – if one of the scarce inspectors saw them.⁸

The need for decent facilities so that workers could wash before eating recurs in early reports. In the 1920s, Adelaide Anderson emphasised "the close relation between good general ventilation, cleanliness (including freedom from dirt, dust, effluvia, and organic impurities), lighting and temperature."⁵ The expression "occupational hygiene" may seem old fashioned now, and confusing to outsiders, but these considerations, and the connection with public hygiene, show how it came about.

Linked with cleanliness was the provision of protective clothing, including respiratory protection. In an enquiry into conditions at a white lead works, also in the 1879 report, a representative of the company reported providing the women "with calico wrappers, caps, and respirators; also leather gloves and waterproof aprons when employed in those parts of the factory where we consider it necessary". I assume that a calico respirator means a simple pad of cotton tied over nose and mouth, but at the same company one of the employees describes respirators "made of japanned tin, with sponge inserted moveable to wash after using."⁸

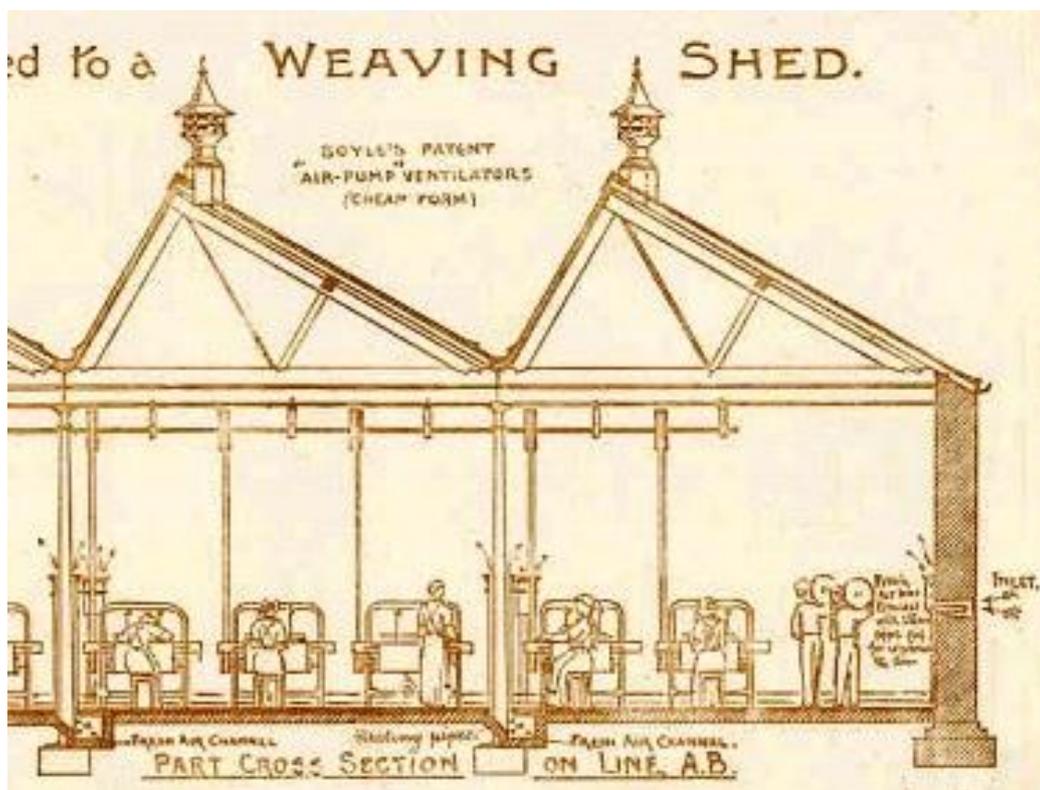


Fig. 4.3. This is part of an illustration, from Robert Boyle and Sons' catalogue, of their ventilation system applied to a weaving shed (undated). The ventilators on the roof had shaped plates so that the external wind sucked air out of the building. Make-up air was supplied through inlets in the floor and walls, and could be heated by hot-water radiators if desired. (By permission of the Heritage Group, Chartered Institution of Building Services Engineers. http://www.hevac-heritage.org/electronic_books/robert_boyle/4-ventilation-2.pdf)

Ventilation

The 1884 Annual Report of the Chief Inspector of Factories, recommended some systems of general ventilation, including that of Robert Boyle and Sons, which used cowls on the roof of a building, designed so that the wind extracted air, with provision for make-up air entering the building elsewhere. Their catalogue illustrated systems for a wide range of premises, including workrooms (Fig 4.3). A particular problem was carbon monoxide poisoning from coal-gas heating or lighting. It was “common practice” to turn the gas supply on centrally and then to go and light the jets, with predictable results. Adelaide Anderson had an enforcement problem on this, because the carbon monoxide was not “generated in the process of manufacture” and therefore arguably not covered by the 1864 and 1878 Acts.⁶

Local exhaust ventilation exhibited problems which are still familiar today: anemometer measurements could give results for airflow from zero upwards. Makeup air could depend on having the windows open, and in some cases came into the workroom through the lavatories.⁸ (From the inspectors’ complaints about some of these facilities the effects must have been unpleasant.)

In his 2004 review in *Annals of Occupational Hygiene*, Tim Carter illustrated two developments from about this time in local ventilation.⁹ Fig 4.4 shows an extraction hood for a grinding stone, taken from an 1877 source. Fig 4.5 comes from an 1884 set of regulations by Bradford Borough Council to control anthrax spores, and shows a downdraft bench for sorting fleeces. The regulations required that the extracted dust must be caught and burnt, and prescribed various measures for disinfection of waste and the rooms, including sprinkling of the floors with disinfectant.

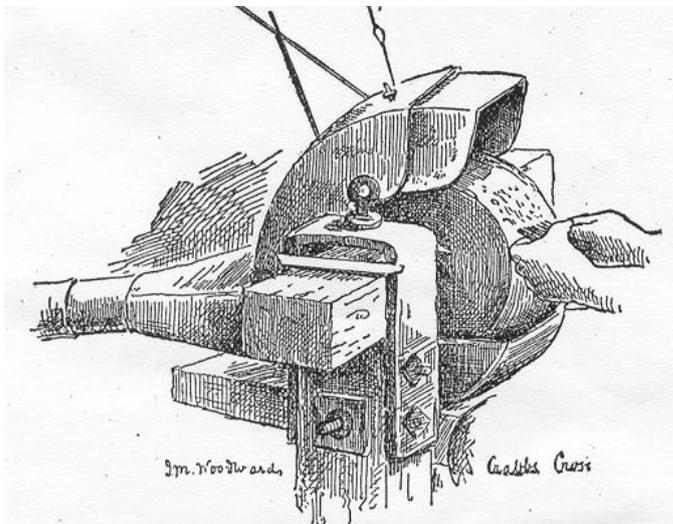


Fig. 4.4. Local exhaust ventilation of a grinding wheel (1877)

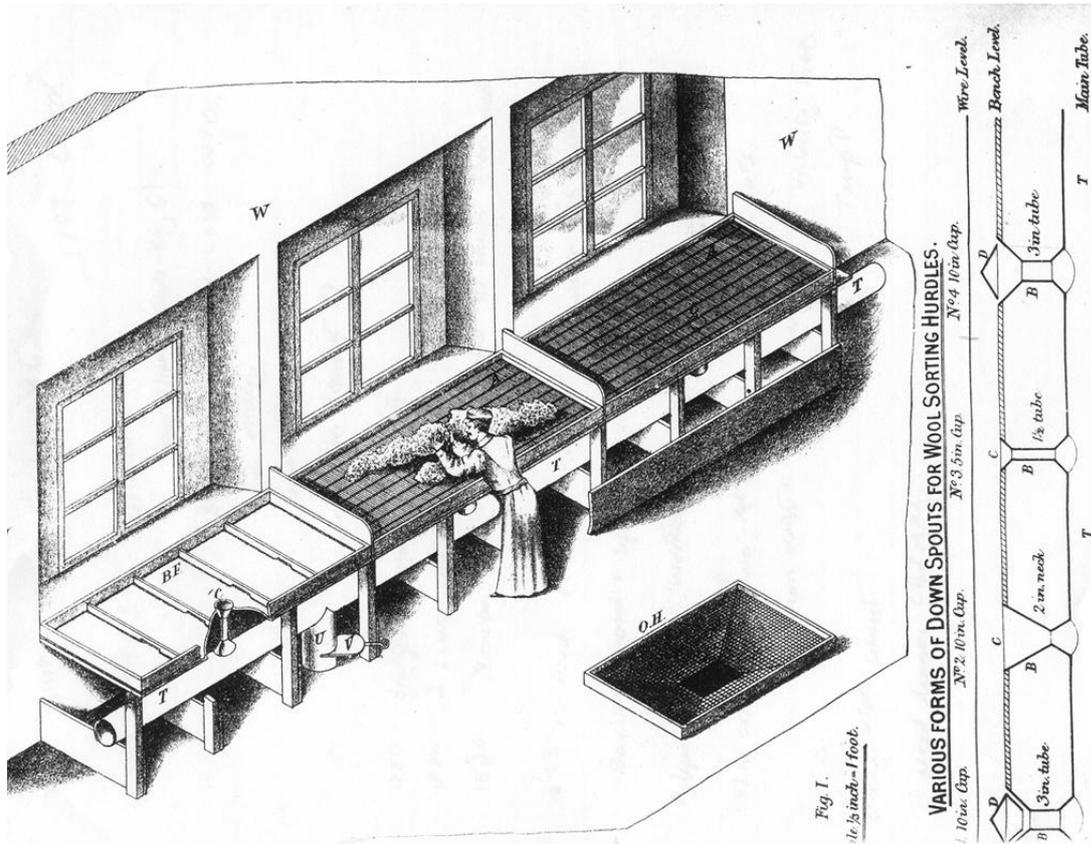


Fig. 4.5. A downdraft bench for sorting fleeces, to avoid anthrax spores becoming airborne, specified by Bradford Borough Council in 1884.

Into the new century

By 1900 there were new tools. The 1891 Factories Act brought in a system of “special rules” for injurious processes, and in 1895 it became a requirement that medical practitioners notify diseases due to certain agents such as lead and arsenic. Adelaide Anderson wrote of a “new movement for applying scientific knowledge”. In 1898, an energetic Medical Chief Inspector, Dr Thomas Legge, was appointed, and in 1899 an Engineering Adviser. The first limits were propagated, for carbon dioxide in air as a test of ventilation, and on the horizon was the possibility of making other measurements in workplace air, and in due course of quantifying risk. But more of this in the following chapters.

¹ C. Turner Thackrah, *The Effects of Arts, Trades, and Professions, and of Civic States and Habits of Living, on Health and Longevity: with Suggestions for the Removal of many of the Agents which produce Disease, and shorten the Duration of Life*. London, Longman, Rees, Orme, Green and Longman; 2nd Edn 1832. <https://books.google.co.uk/books?id=enmv5jq4FbEC>

J Tim Carter and Anne Spurgeon wrote an informative modern review of this book and its context and influence at *Occupational Medicine*, 67(6), 500–501 (2017).

² Commissioners for Inquiring into the Employment and Conditions of Children in Mines and Manufactories, *The condition and treatment of the children employed in the mines and collieries of the United Kingdom*. London, William Strange, 1842. <https://www.bl.uk/collection-items/report-on-child-labour-1842>

³ Quoted by John Bridge, 1933 Chief Inspector of Factories Annual Report; chapter 3, *Health*.

⁴ 1878 Chief Inspector of Factories Annual Report

⁵ Adelaide M Anderson, *Women in the Factory: An Administrative Adventure 1893-1921*. London, John Murray, 1922. (London, Forgotten Books, 2015, ISBN 978-1-332-21304-7)

⁶ Anne Spurgeon, *Women and Children in the Factory. A Life of Adelaide Anderson (1863-1936)*. Malvern, Aspect Design, 2016.

⁷ 1879 Chief Inspector of Factories Annual Report.

⁸ 1900 Chief Inspector of Factories Annual Report

⁹ Carter T (2004), British occupational hygiene practice 1720-1920, *Ann Occ Hyg* 48(4): 299-307.