

Lloyd's Paper Mills, Bow Bridge

Matt McKenzie

Edward Lloyd (1815–1890)¹ was one of the most prolific publishers of popular fiction in the 19th century as well as a successful newspaper proprietor but his name is scarcely mentioned in books on the history of the Press which concentrate on *The Times*.

In the first quarter of the nineteenth century there was an increasingly literate working population in Britain hungry for news, knowledge, fiction and entertainment. Satisfying this demand at an affordable cost had become a serious problem due to the 'Taxes on Knowledge'—Newspaper Stamp Duty, a tax applied to every newspaper, Paper Duty, levied on paper at the point of manufacture and Advertising Duty, a tax on advertising in publications.²

The increasing regulation of publishing began in January 1799 when the House of Lords passed a "Printing Regulation" bill requiring printers and authors to register their names. There were so many objections to restricting the freedom of the press that the taxes on paper, newspapers, and advertisements were only slipped in as a revenue-raising measure along with taxation of soap and silk in 1712.³

These taxes were raised periodically and by the 1830s the Stamp Duty for newspapers stood at 4d., Paper Duty at 3d. per lb., and Advertising Duty at 3s. 6d. These increased costs denied valuable revenue streams for newspapers, and combined to raise the price well beyond the cost of production and out of reach of working people. The 1830s saw a proliferation of unstamped publications protesting at the effective suppression of news for the populous and in 1836, with a change of government, the Newspaper Stamp Duty was reduced to one penny and the unstamped papers ruthlessly suppressed.⁴

At this time, Lloyd was producing many penny serial novels, and penny weekly publications masquerading as newspapers, although they contained no news thus avoiding the Stamp Duty. *His Penny Sunday Times and People's Police Gazette*, launched in 1841, contained historical or fictional sensational crime stories and serial fiction. Also, predating the *Illustrated London News* by some two years, it featured a large wood engraving illustration on the front page. Illustrations were particularly attractive to those whose reading skills were only just developing and it was Lloyd's ingenuity that meant that the illustration alone carried a contemporary news story—any accompanying text being merely historical or background information.

In this way was reported the gruesome crime committed by François Benjamin Courvoisier, a valet, who murdered his employer Lord William Russell and whose execution on 6 July 1840 was witnessed by some 40,000 people including the horrified William Thackeray.⁵ Every step of the story, from the reconstruction of the murder, the trial, the condemned man in his cell and the execution itself were illustrated in detail on the front page over several weeks.

In the same year as the establishment of the *News of the World*, 1842, and Herbert Ingram's *London Illustrated News*, Lloyd introduced *Lloyd's Penny Illustrated Newspaper*. It contained:



Figure 1. Portrait of Edward Lloyd (1815–1890)



Figure 2: The *Sunday Times* and *People's Police Gazette*

Figure 3: *Lloyd's Illustrated London Newspaper*, 8 January 1843

Eighteen Engravings, executed in the first style of art, of her most gracious Majesty's Return, and other highly interesting subjects, illustrative of her Visit to Scotland.⁶

The masthead bore a remarkable similarity to the *London Illustrated News* featuring boats in the Thames with St. Paul's in the background and many commentators have suggested that Lloyd was copying another's formula, although it could equally be said that Ingram was copying Lloyd's formula of the *Penny Sunday Times*. Despite containing no actual news after seven issues the authorities required it to be stamped.

Lloyd's editor at the time was William Carpenter, who had been imprisoned in the 1830s for defying the government's imposition of Stamp Duty, and Lloyd decided to relaunch the newspaper as *Lloyd's Illustrated London Newspaper* on 27 November 1842 with the Stamp and an increased cover price to compensate. Far from complaining about the imposition of the tax, Lloyd now embraced the opportunity to be a newspaper proprietor as demonstrated by this rather wordy prose from the first edition.

And here we may remark, although in no ill spirit towards that law which obliges us to stamp our Journal, that it cannot fail to strike our numerous friends and patrons, that if, while labouring under a restrictive legal enactment we were enabled to present to them a Newspaper, which was finding its place in thousands of the highest families in this kingdom, as well as cheering the fire-side of the humblest mechanic, and rendering lightsome his hours of labour, how much more shall we be enabled to do now that we have struck the shackles from our hands, and come forward with our news legalized by that stamp, the want of which did, to a certain extent, cripple our exertions.⁷

Illustrations had been a central feature of Lloyd's publications but after seven issues, on 15 January 1843, it became *Lloyd's Weekly London Newspaper* without the illustrations, at twopence ha'penny and five columns instead of three. Lloyd claimed that the illustrations were using up valuable space as

The graphic delineations of the Pen speak more forcibly to the heart than the more finished efforts of pictorial art,

and it is quite possible that he had now found a growing literate audience hungry for news at a good price who didn't need illustrations to assist them.



Figure 4. OS Map (1869) of the Bow Bridge site

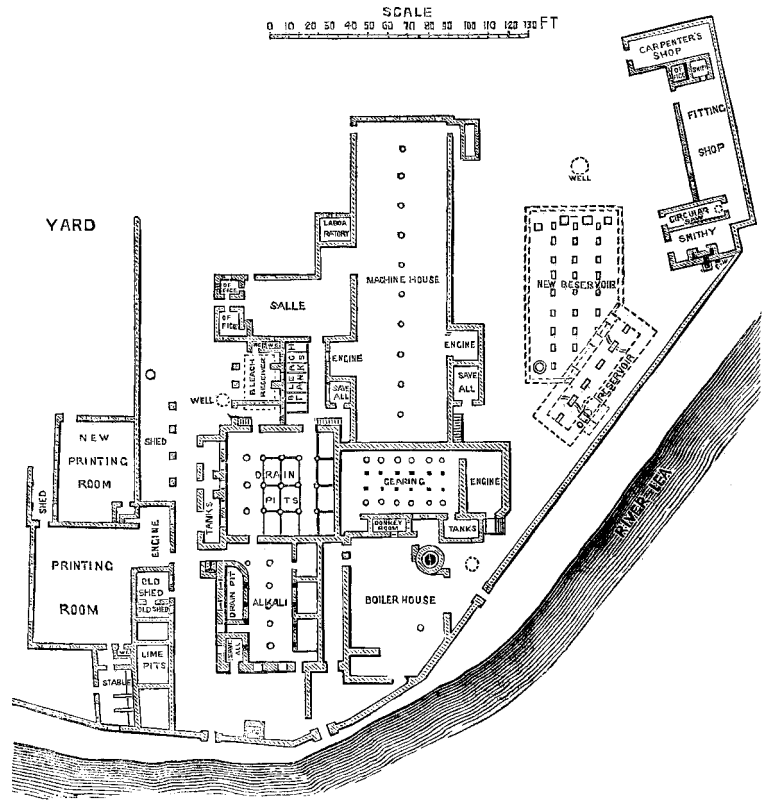


Figure 5. Plan of Lloyd's Paper Mills, Bow Bridge. *The Engineer*, 26 July 1867

Lloyd was always quick to see opportunities to sell his newspapers and make the business profitable. Increasing circulations during the 1840s and 1850s caused him to invest heavily in new technology to meet the growing demand. The Advertising Duty was removed in 1853, the Newspaper Stamp Duty in 1855, and towards the end of the 1850s it seemed as though the final tax on knowledge, the Paper Duty, was about to be removed. This would naturally lower the cost of paper and newspapers printed on it and the resultant explosion of cheap newspapers would cause a paper shortage.

Bow Bridge

In anticipation, on 27 May 1859, Lloyd acquired the lease to two acres of property at Bow Bridge on the river Lea. A conveyance between William Man and Edward Lloyd, 27 May 1859, says:

From William Man junior to Edward Lloyd several adjacent pieces of land (formerly part of a larger piece of land known as the Wilderness) in Bromley, lying between the River Lea and St. Mary's Church, Bromley, partly bounded by Hancock Road and Priory Street, with the dwelling house and industrial buildings (paper mill, printing offices, engineer's shop, foundry, etc.) built thereon, for £3875.⁸

It was reported in *Lloyd's Weekly Newspaper* on 15 September 1861, when the paper duty was finally removed, that the

Proprietor, at the expense of thirty thousand pounds, has had paper mills erected at Bow-Bridge, covering two acres of ground, and fitted with costly machinery. In addition, he has entered into extensive contracts with paper makers in all parts of the country; and four gigantic printing machines are being manufactured at Hoe's Great Rotary Machine works in New York.⁹

The plan in Figure 5, reproduced from an article in *The Engineer*,¹⁰ shows the storage and machinery needed for papermaking, and two large rooms named 'Printing Room' and 'New Printing Room'.



Figure 6. Esparto grass
(*Stipa tenacissima*)

Papermaking requires a large amount of water and the works at Bow Bridge were ideally situated next to the River Lea, not just for the water, but also for the ease of transport of materials and fuel. The OS map (Figure 4) shows the weighing machine and a track for moving materials from the river to the warehouse and the plan of the works shows a large reservoir where water pumped from the river was allowed to settle to remove any earthy matter, purified further by passing over stones, and finally stored in tanks until needed.¹¹

Lloyd had naturally foreseen the great increase in demand for paper that would occur after the removal of the duty and also the resultant shortage of raw materials—traditionally recycled cotton or linen rags.¹²

The American Civil War (1861–1865) interrupted the supply of baled cotton and the price of raw cotton increased dramatically causing a depression in the Lancashire textile industry as their export output was no longer competitive.

To make up the local shortfall, cotton and linen rags were imported from the Continent. This was not without its own problems as most European countries levied heavy duties on the export of rags (£4 per ton in Holland, £5 per ton in France and Belgium and £9 per ton in Prussia),¹³ whilst the export of rags from Britain was free, leading to a further shortage in the supply of rags to paper-makers in England.

Paper-makers had been trying to find new source materials and as early as 1800, Matthias Koops was granted three patents for his process to make paper out of straw, hay and thistles. In 1801 he produced a book, *An Historical Account of the Invention of Paper*, printed on paper made from straw and a variety of other materials.¹⁴ His endeavour was not successful, however, and his factory closed in 1804.¹⁵

Esparto

Esparto grass, *Stipa tenacissima*¹⁶, shown in Figure 6, which grows on the southern coast of Spain and the northern coast of Algeria, was found to be a suitable raw material, having a good structure and requiring less processing than straw. The first patent for its use was in the name of Miles Berry in 1839¹⁷ but Thomas Routledge was the first British papermaker to use it successfully in his paper mill at Eynsham, Oxford, from 1859 and subsequently at the Ford Works near South Hylton in Sunderland. Here he made paper itself and also shipped semi-processed material (half-stuff) to the John Dickinson Mills in Hemel Hempstead.¹⁸

Routledge had attempted to monopolise the import of esparto from Spain, but Lloyd managed to obtain abundant supplies from Algeria and made shipments to England from the port of Oran where esparto was a useful return cargo for ships that had exported coal to fuel steam ships in that region. This trade was so important to the Algerian economy that there is even a memorial to Lloyd in Holy Trinity Church, Algiers honouring him as 'The first to show the value of alfa fibre for the manufacture of paper'. Indeed, Lloyd was so successful with his use of esparto that he was given credit for its introduction to British papermaking in a widely published article written by the British Consul at Malaga.¹⁹ Routledge indignantly wrote to several papers complaining that

the first sheet of paper Mr Lloyd saw made from esparto was at my mills at Eynsham, near Oxford, where he came to ascertain my method of treatment; and the first esparto that entered his mill at Bow was purchased from me in January 1862.—THOMAS ROUTLEDGE²⁰

Straw and esparto grass do require more processing than recycled cotton or linen rags as the raw material contains lignin (part of the plant's structure) which must be separated from the cellulose as it yellows with age and weakens the resulting paper. This is done with a caustic solution which degrades and dissolves the lignin so that the fibres in the material are easily separated.

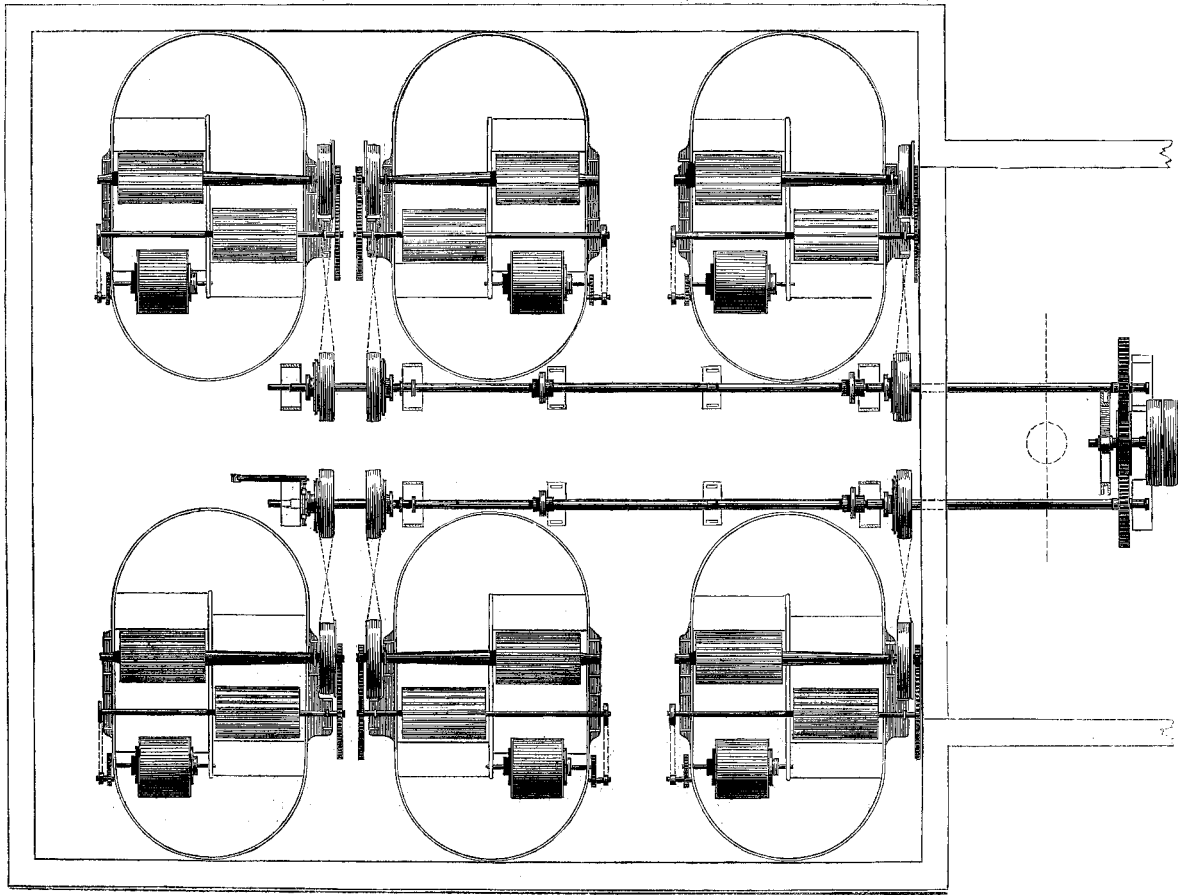


Figure 7. Arrangement of Hollander beating engines at Bow Bridge

In 1851, Charles Watt and Hugh Burgess developed the soda process for treating wood chips and although it was not immediately used commercially in England, it found favour in America where suitable wood was more plentiful. Nevertheless, the essential feature of the process—boiling plant material in sodium carbonate or sodium hydroxide to separate the cellulose from lignin—could be applied successfully to straw and esparto.

The machinery

In Lloyd's mill at Bow Bridge, agricultural chaff cutter machinery, capable of cutting 18cwt. of material per hour, was used to cut the esparto into half-inch lengths.²¹ In a boiler, lime (calcium hydroxide, $\text{Ca}(\text{OH})_2$) and soda ash (sodium carbonate, Na_2CO_3) were mixed together with water to produce lye (sodium hydroxide, NaOH) which remains in solution and calcium carbonate (CaCO_3) which is precipitated out.

The chopped esparto was then put into one of the three rotating boilers, shown in Figure 7, capable of boiling two tons of material each, and the lye solution pumped up into it using steam and the most ingenious Giffard injector shown in Figure 8.²² This device merges a high pressure stream at A, (steam in this case) with a low pressure one, E, (the lye) carrying the latter along with the former to its destination, K. This device also found use in steam locomotives, and as a pump to remove water from coal mines.

The boiler was sealed and revolved under steam pressure for some three hours before the caustic solution was drained into storage tanks for reprocessing and the steam released to heat a tank of clean water which in turn was used to wash the fibres.

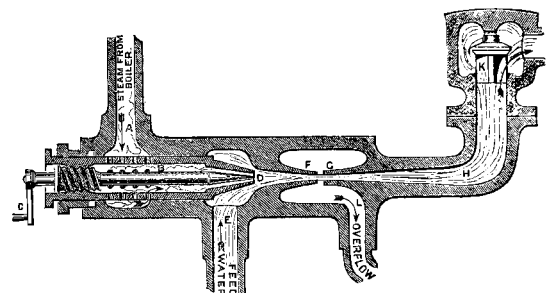


Figure 8. The Giffard Injector

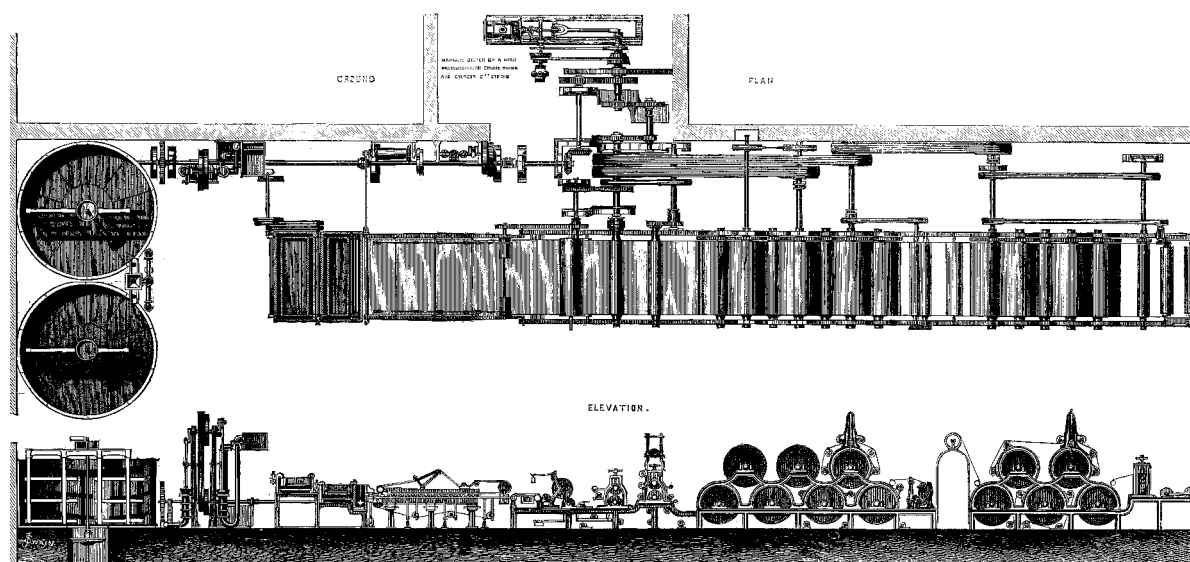


Figure 9. The Fourdrinier papermaking machine at Bow Bridge, manufactured by Bertram's of Edinburgh

At this point in the process, the fibres were referred to as 'half-stuff' and it was often the case that the processing of the raw material was carried out at one plant and the final manufacture of paper at another. Indeed, after Lloyd bought another paper mill in Sittingbourne, Kent, he would do exactly that, only carrying out the final stages at Bow.

The pulp was then placed into bleaching vessels with chlorine (a solution of calcium hypochlorite, $\text{Ca}(\text{OCl})_2$) and, when white, washed again and transferred to one of the six Hollander beaters (Figure 7).²³ These beaters replaced traditional stamping machines and reduced the size of the fibres by the action of the rotating blades. The resultant pulp was then put through another filter to remove any knots or similar impurities.

Finally, the pulp was introduced to the Fourdrinier papermaking machine manufactured by George Bertram of Edinburgh (Figure 9).²⁴ This was their No. 21 paper-making machine and Lloyd's No. 2 machine and was 90in. wide.²⁵ The mould consisted of a continuous woven wire mesh with 4225 holes to the square foot and passed over a suction box to extract as much water as possible as well as being vibrated to settle the fibres. The nascent paper was laid onto the couch rolls which were felt-covered and made of wood. The paper was then passed between the two drying sections of steel rollers heated by steam before passing through the calendering rollers to give it a smooth surface. The final reel was 2810ft. long and 93in. wide. The machine was driven directly by a steam engine shown at the top of Figure 9.

Before the removal of the paper duty, it was *required* to cut this reel of paper into sheets as the tax was levied on the weight of cut sheets. This had impeded the development of web-fed rotary printing presses and it was nearly fifteen years before further technical developments made them possible. So in 1867, the reel was still cut into sheets to suit the Hoe ten-cylinder presses that Lloyd had been using to print *Lloyd's Weekly Newspaper*.

Hoe & Co.'s Type-Revolving Machine

Newspaper circulation grew from around 4000 at the turn of the century to hundreds of thousands by the 1850s. The traditional hand press could only manage 250 impressions per hour and although the development of the flat-bed cylinder press in 1813 by Koenig²⁶ allowed a fourfold increase in production, it was still not enough to satisfy the demand. Machines with up to four impression cylinders were developed but their throughput was still restricted by the nature of the reciprocating flat-bed of type which was mechanically inefficient.

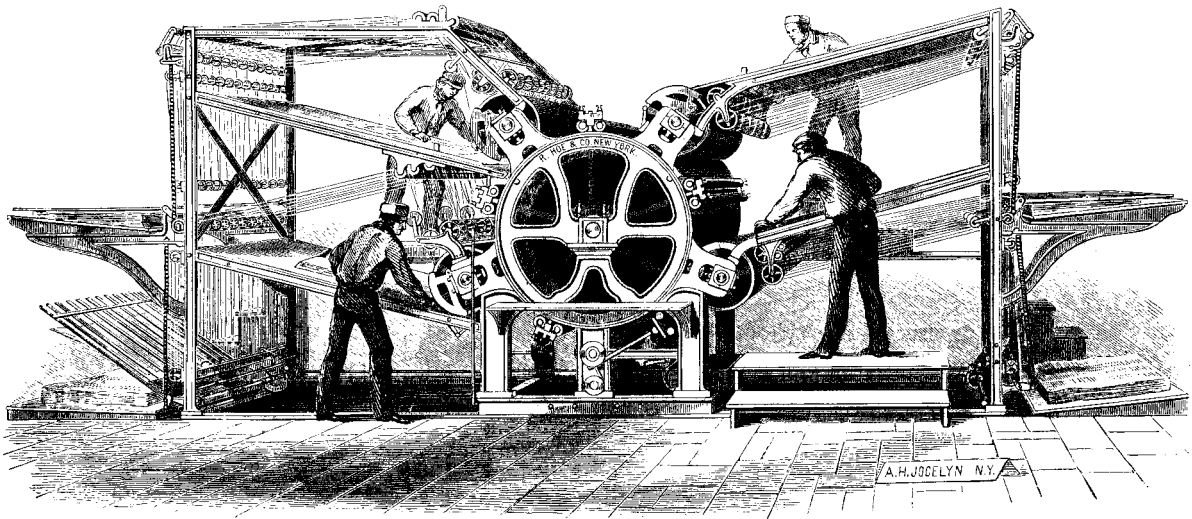


Figure 10. Hoe & Co. four-feeder type-revolving machine

There were many attempts to create a curved printing surface such as that used in the textile industry and David Napier²⁷ patented a design in 1837 suggesting the placement of type on an immense cylinder surrounded by a number of impression cylinders, but it was never implemented. In 1846, Applegath and Cowper had applied a similar principle to their machine for *The Times*, but they had mounted the type cylinder on a vertical axis and the resulting paper path was very complicated.

In the same year, Richard March Hoe developed a practical application of Napier's idea. The type was held in columns in a special curved chase and bed called a *turtle* (Figure 11).²⁸ The lines between the column were actually V-shaped—thicker at the top than at the bottom—and this, with the curved bed of the chase, allowed the type to follow the circumference of the large cylinder. These column lines were parallel to the axis of the cylinder and so could be straight whilst head, advertising, and dash rules were made with a curve to match that of the cylinder.²⁹ The beauty of this system was that ordinary type could be set and proofed as normal and then transferred to the turtle.

The four-feeder machine has four impression cylinders which print the forme in turn as the type cylinder rotates. The printing surface only occupies part of the cylinder, the rest is taken up by an inking distribution table which is lower than the type so it doesn't touch the impression cylinders. Two inking rollers precede each impression cylinder inking the type on each revolution. The ink is replenished by a vibrating distributing roller, and ducter roller, transferring it from a fountain mounted at the base of the machine.³⁰

Hoe's first such machine (Figure 10) was installed in 1847 at the *Public Ledger* in Philadelphia and later in Paris at the offices of *La Patrie* in 1848. The cylinder rotated at the rate of 2000 revolutions per hour and would deliver 8000 impressions in that time. Lloyd was reported to have visited Paris to see the installation of the novel technology. Unfortunately, having recently made some expensive improvements to the printing of his newspaper and in debt to his paper suppliers, he could not immediately make a further investment.

After the removal of newspaper duty in 1855, Lloyd reduced the price of his newspaper and the imperative of an expanding circulation meant that, in 1856, he ordered his own six-feeder machine from Hoe & Co. It arrived in June from New York on the *Emerson* along with eight engineers to assist with its installation³¹ and on Sunday 13 July 1856, *Lloyd's Weekly London Newspaper* was printed on the new machine at a rate of 'fifteen thousand per hour'.³² This increased speed of production meant that printing could be undertaken later in the week than

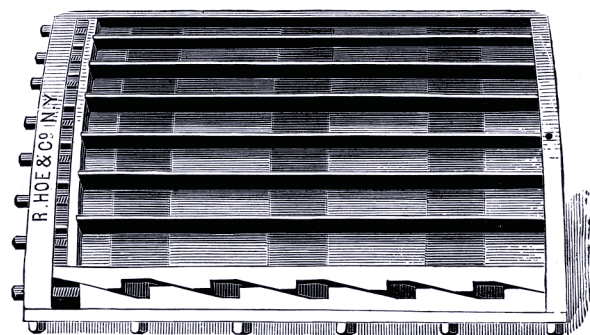


Figure 11. The special curved 'turtle' chase

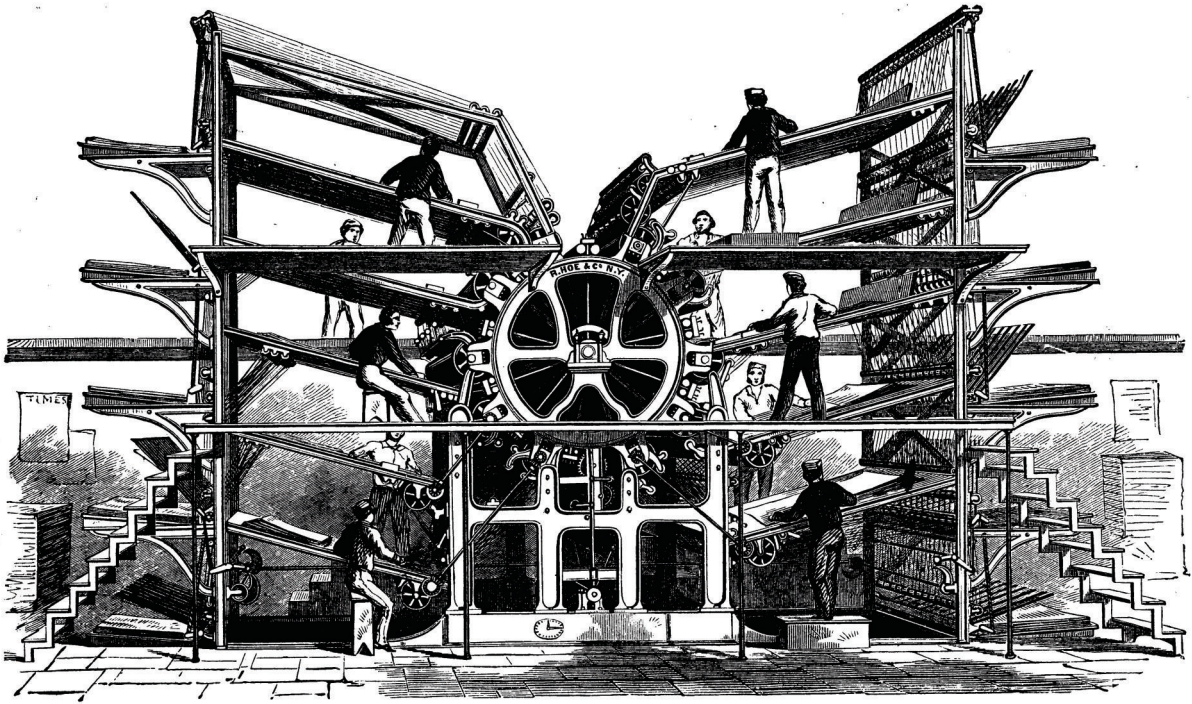


Figure 12. Hoe ten-feeder type-revolving machine

formerly and late news could be inserted up to the very moment of publication.

As this was the first of his machines to be used in a British newspaper, Richard Hoe had given Lloyd a 50% discount. But when Lloyd wanted a second machine, Hoe at first refused to supply it at the same price until convinced by Lloyd that it would be in his own interest for there to be a backup in case of failure which would surely damage Hoe's reputation.³³ Indeed, the installation at Lloyd's became a showroom for sales to other newspaper proprietors and Hoe & Co. soon received orders from the *Telegraph*, *Illustrated London News*, *Manchester Guardian*, *Edinburgh Scotsman*, *Glasgow Herald* and, in particular, *The Times* which ordered two ten-feeder machines (Figure 12).³⁴ *The Times*, however, insisted that the machines were made in England rather than being imported from America. The work was contracted to Joseph Whitworth and Co. of Manchester with whom Hoe already had a connection as makers of machine tools. However, the construction of the machines was beset with difficulties due to bad castings, inferior materials, modifications and unauthorised 'improvements'. The first machine was delivered six months late and the situation was only improved after Hoe's own engineer, William Conquest, took charge of the work in Manchester.³⁵

Installation at Bow Bridge

The report in *Lloyd's Weekly* on the acquisition of the site at Bow in 1861 mentions the impending arrival of four "gigantic printing machines". These would prove to be the Hoe ten-feeder presses, shown in Figure 13.

It is not clear how much ancillary equipment needed for the printing operation was originally installed at Bow and by the time of Crory's visit in 1876, the Hoe ten-feeder machines were already obsolete with production moving to web-fed machines, but during the Christmas holiday in 1873 there was a disastrous fire at Lloyd's premises off Fleet Street which destroyed one of his original Hoe six-feeder machines, a new Hoe web perfecting press, the composing room and foundry.³⁶ Lloyd declined offers of assistance from other newspapers and the next issue appeared as normal, from which we can conclude that everything necessary for production also was installed at Bow.

Steam power

All the machinery on site needed to be driven by engines and much steam also had to be generated for the papermaking processes themselves. *The Engineer* in 1867, described

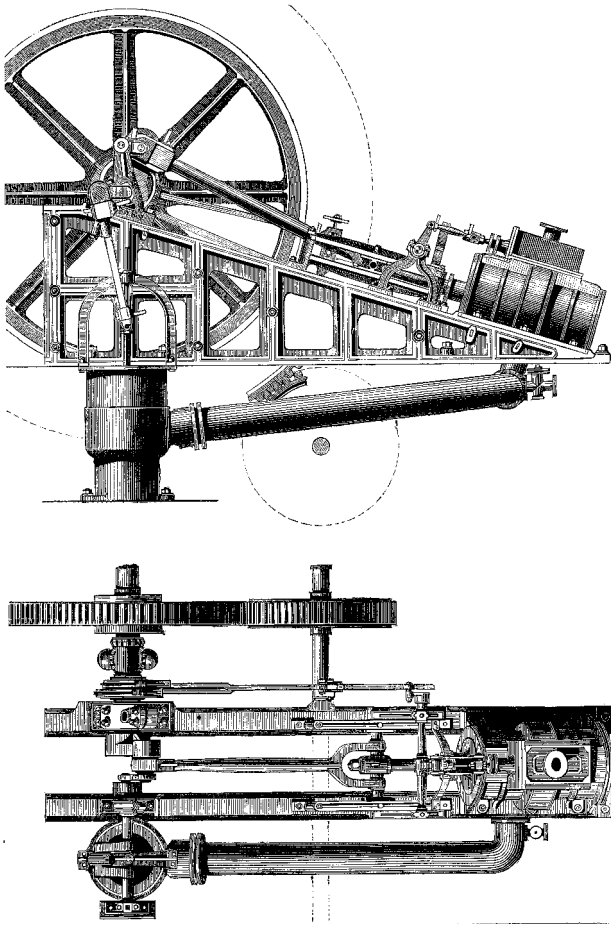


Figure 13. Bertram engine at Lloyd's Paper Mills

lessening of manual toil and elevation of industrial labour. The system of machinery at work is the best of its kind, and evidently capital has been invested with no miser's reserves in getting up every part of the Works.³⁸

He also described the paper mill at Bow as "well worthy of a place amongst the chief of East London Industries" and at the time of his guided tour, by Lloyd's son Frank, it employed over 200 workers.

Sittingbourne

Although Lloyd had bought another paper mill in Sittingbourne in 1863, he used the Bow site in conjunction with it until the water in Lea had become too polluted and in 1877 all the papermaking operations were moved to Kent.³⁹

Conclusion

Edward Lloyd was always one to take advantage of new technologies and seize any opportunity to streamline production. His establishment of the papermaking operation at Bow allowed him to be independent of paper suppliers and control costs in all aspects of his production. He had always supported working people and when he first launched the unstamped *Lloyd's Penny Illustrated London Newspaper* in 1842, it was priced at one penny before he was forced to increase its price by the Stamp Office. When all the Taxes on Knowledge were removed he could return the price to the iconic one penny.

After Lloyd's death in 1890, his son Frank further developed the paper mills in Kent, introducing wood pulp sourced from Norway, leading to it becoming the largest paper mill in the world in 1911. The site at Bow was subleased to an iron foundry in 1892 and is now being redeveloped.

the engine which works the whole of these machines, by Geo. Bertram, of Edinburgh (Figure 13); it is an angular condensing engine, having a pair of cylinders 28in. diameter, with a 3ft. 6in. stroke, each cylinder having its separate condenser and air pump driven with malleable iron cranks ancillary shafts, and a drag link from the main crank pin. The fly-wheel is 18ft. 6in. in diameter, 10in. wide, on face of teeth being a wrought wheel 3in. pitch. The motion is taken from the fly-wheel with a cogged pinion, 5ft. 6in. diameter, fitted together in two halves so as to come easily off when another pinion is required to go on. The line of shafting which this pinion drives passes into the beating engine house below, motive power being taken off to the different beaters by means of belts and pulleys on Bertram's well-known plan, introduced by him many years since into paper machinery.³⁷

The important point was that the motive power from this engine was distributed to the entire factory by the system of shafts and belts, common at the time. Ten years later, the number of engines had increased, as noted by Crory:

There are several engines and some four or five boilers. One of these is being fuelled by one of Dillwyn Smith's mechanical stokers. [...] Appliances are visible all over the premises for the

Acknowledgements

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The author

Matt McKenzie, BSc, MA, has a letterpress printing workshop, Paekakariki Press, in Walthamstow keeping alive the traditional methods of printing in danger of dying out in the digital age. He discovered the existence of Edward Lloyd from a leaflet handed out at the William Morris Gallery (Lloyd's former home) on the bicentenary of his birth in 2015 and became determined to find out more about this interesting, dynamic and yet forgotten "Father of the Cheap Press". He contributed a chapter to the recently published *Edward Lloyd and His World*.

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