Presswork

THE WOODEN HAND-PRESS

All printers used what was substantially the same sort of printing press throughout the hand-press period, a hand-powered screw press built in a wooden frame. Wooden hand-presses were constructed and used in ways that varied slightly from country to country and from time to time, but the differences were neither considerable nor mechanically important. The description which follows of the English printing press of the seventeenth and eighteenth centuries applies, with but few changes, to presses elsewhere in Europe and, so far as we can tell, to presses of the sixteenth century as well.[1]

The common press—so called to differentiate it originally from the copperplate printer's rolling press, and later from the iron hand-press—consisted of a wooden frame which contained two groups of moving parts. These moving parts were the carriage assembly, which carried the type and paper in and out of the press so that the type could be inked and the paper changed after each impression; and the impression assembly, by means of which the paper was pressed down on to the inked type. The chief members of the frame were two upright cheeks about 2 m. high and placed 60–65 cm. apart, carrying between them the winter and, above it, the head, two massive cross timbers mortised into the cheeks which contained the vertical thrust of the impression; and the cheeks were braced from their tops to the ceiling, to prevent the press from twisting or shifting about in use.

The carriage assembly ran horizontally fore and aft between the cheeks, about 75 cm. from the ground. Two ribs, or rails, ran across the winter to supports at their ends, and on them slid the moving parts of the carriage: a plank on which was mounted the coffin, a shallow box containing the press stone. This stone was a block of marble or limestone with a top measuring about 62 × 47 cm. The plank was hauled in and out between the cheeks by girths at each end which were wound round a small windlass underneath the ribs.

When a forme was in place on the press stone, paper was lowered on to it by means of a tympan and frisket. The tympan consisted of a parchment-

[1] Based on the research for Gaskell, P., *The decline of the common press*, Cambridge University Ph.D. thesis 2902, 1956; for a detailed census of surviving wooden presses, with measurements and illustrations, see Gaskell, P., 'A census of wooden presses', *Journal of the Printing Historical Society*, vi, 1970, pp. 1–32.

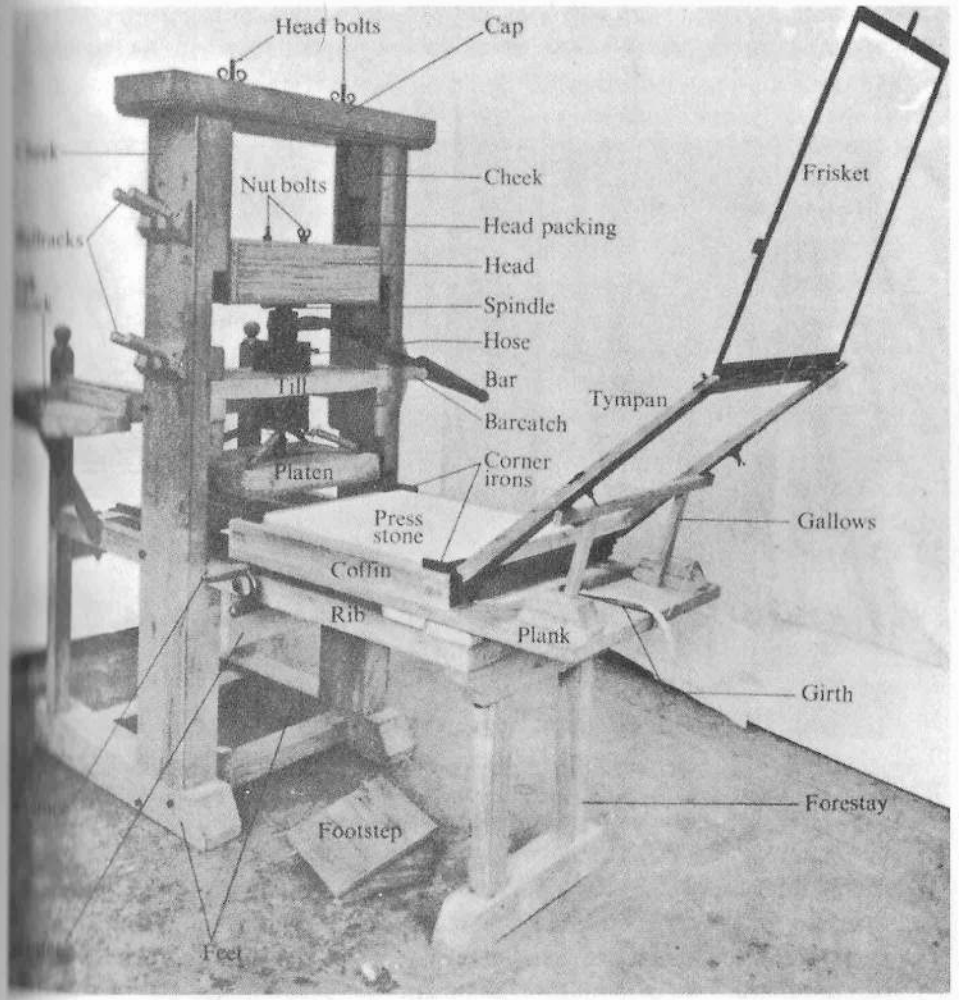

FIG. 64. A modern replica of a late-eighteenth-century English common press, with the names of its parts. The tympan and frisket would normally be covered, and there would be wooden braces from the cap to the roof.

covered frame of wood and iron hinged to the front end of the coffin; measuring about 66–72 × 51–59 cm. over-all, it was packed with sheets of cloth or paper held behind the parchment with an inner frame (the inner tympan). The printing paper was laid upon the parchment of the open tympan, where it was pierced by two points, adjustable pins bolted to the frame of the tympan; it was then held in place on the points by the frisket, a further iron frame hinged to the top of the tympan, and covered with

parchment or paper cut with holes to let the inked type print through when paper, tympan, and frisket were folded down together on to the forme.

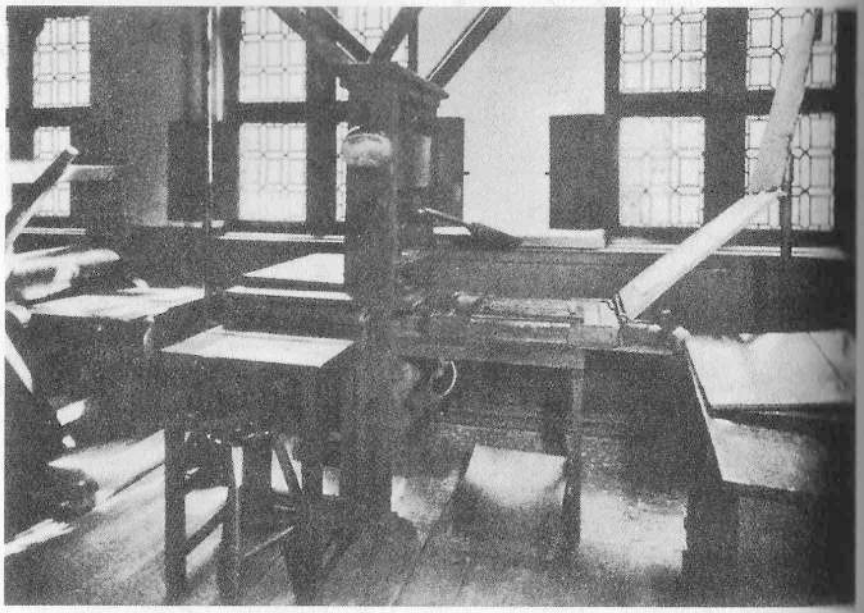

FIG. 65. A Low Countries common press (probably eighteenth-century, Gaskell B3) in the Plantin-Moretus shop at Antwerp. A forme is laid but not fixed on the stone, and an ink-ball hangs on the cheek. On the right is the paper bank, and a rolling press can just be seen on the left.

The impression assembly hung from the head of the press between the cheeks and above the winter. The winter was not adjustable for height within its mortises, but the head was tenoned into long mortises in which it could be raised and lowered to adjust the height of the impression assembly. In English, Dutch, and some French presses the head was slung on two bolts from the cap, a smaller timber that joined the tops of the cheeks, and it was drawn up tight against packing in the tops of the mortises; the height of the head was adjusted by altering the amount of packing above the head tenons. German, Scandinavian, and probably Italian presses, on the other hand, had no cap, and the head was adjusted by the insertion of packing both above and below the head tenons.

Embedded in the head was a brass nut, and in the nut worked the spindle, a steel bar 60 cm. long, of which the top 13 cm. were cut as a screw. Immediately below the screw the spindle was squared and pierced to take the bar, a crooked iron rod with a wooden handle. Further down still the shank

of the spindle, rounded again, entered the hose, which was an oblong rectangular wooden box, 25 cm. long by 12·5 cm. square, bored with a hole to take the spindle down its long axis. When the bar was pulled through about 90° and then returned to its former position, the spindle moved down about 15 mm. in the nut and then up again. The hose, which had an internal collar slotted into the spindle, moved down and up too, but it was prevented from rotating with the spindle by the till, a plank fixed between the cheeks beneath the head which was pierced with a rectangular hole to take the hose. The bottom, or toe, of the spindle rested in a metal cup on the back of the platen, the flat-bottomed block which was pressed by it on to the back of the tympan, and so pushed the paper on to the inked type. The platen was lashed up tight to the toe of the spindle by cords which connected hooks at its four corners to another set of hooks at the four lower corners of the hose. Thus the platen was held in permanent contact with the toe of the spindle, moving up and down with it as it was turned, but being unable to turn with it.

An alternative form of hose, probably invented in Holland in the earlier seventeenth century, took the form of an iron yoke on either side of the spindle in place of the wooden box. The mechanical difference between the two forms was slight, and iron hoses, though widely known, remained rare outside the Netherlands.

The platen (generally made of hardwood, but occasionally cast or faced in metal) measured 45–49 × 29–32 cm. at the face, its longer dimension running from side to side of the press. It thus covered half of the back of the tympan, so that the press had to be worked twice, with the carriage in different positions, for the whole of the tympan to be pressed by the platen.

The size of the type area that could be worked on the common press was limited in theory by the dimensions of the platen and of the press stone. A small platen could in two pulls cover a type area of 58 × 45 cm., a large one 64 × 49 cm. (although they would not print well at the very edge); while the press stone generally measured about 62 × 47 cm. In practice, however, printers were limited by the inside dimensions of the standard chase (about 52 × 42 cm.) less a minimum of about 3 cm. each way for furniture and quoins. Thus in normal working the type area was limited to about 49 × 39 cm. (19 × 15½ in.), but with a large press and a large chase it could be pushed up to about 62 × 47 cm. (24½ × 18½ in.).[2]

The size of the paper that the press could take was limited by the length

[2] The larger press could thus work a type area 50 per cent greater than that worked by the smaller one. Moxon's mid-seventeenth-century Dutch press was small, Stower's late-eighteenth-century English press was large (Moxon, J., op. cit., § 10; Stower, C., *The printer's grammar*, London 1808, ch. xii).

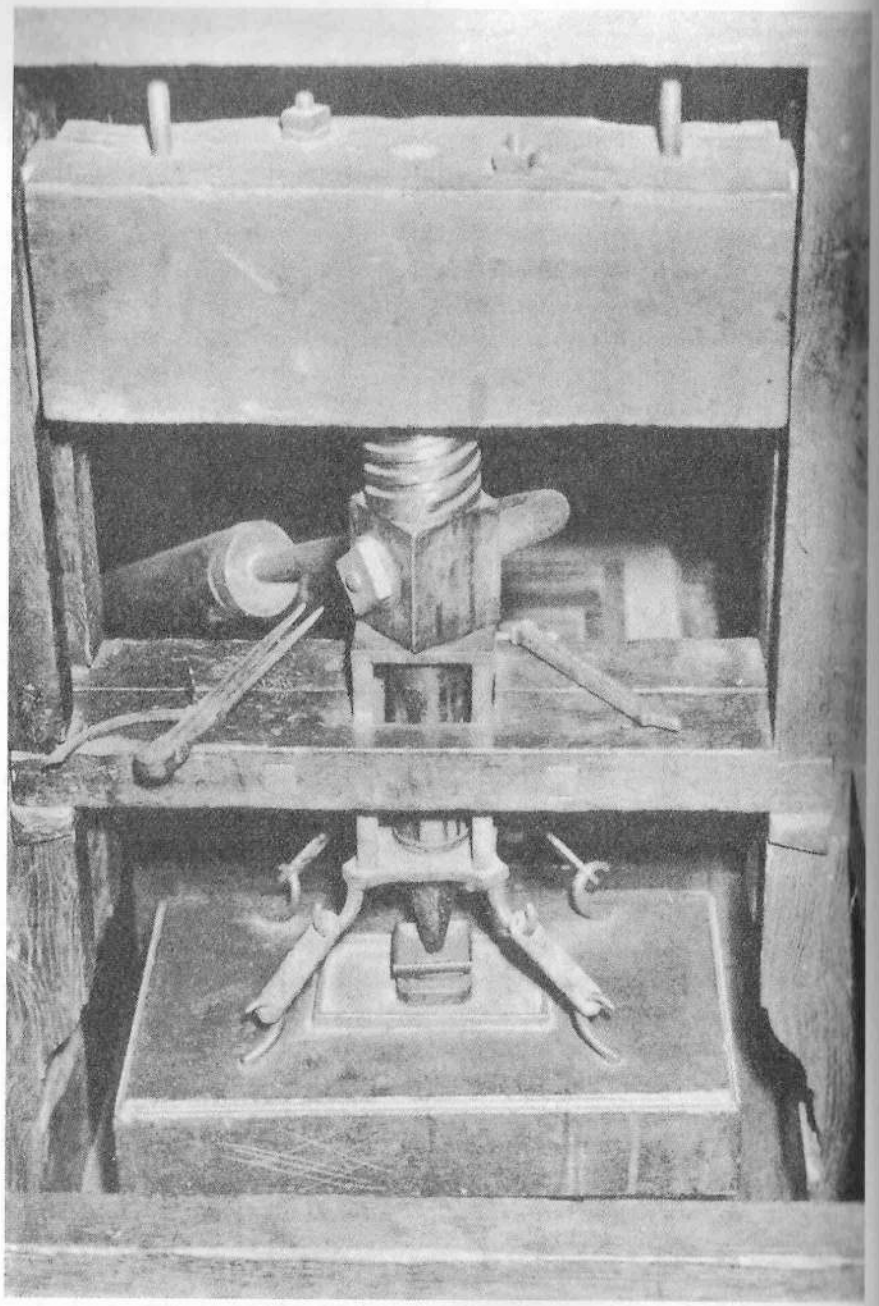

FIG. 66. The impression assembly of a press by Ouram of Philadelphia, *c.* 1804, seen from behind. The open box-hose and large-diameter screw were characteristic of early-nineteenth-century American presses. The unadjustable metal links between hose and platen are probably not original but replace an earlier lashing of cord. Lying on the till are a pair of dividers and a metal shooting-stick (Pennsylvania Historical Society, Ephrata; Gaskell USA 11).

of the tympan, for the sheet could not be longer than the distance between the hinges at its ends, and tympans were made wide enough to take paper of this maximum length. The length of Moxon's tympan (1683) was 66 cm., so that the largest standard paper size that it could accommodate was royal (*c.* 60×46 cm.). The tympans of surviving eighteenth-century common presses are around 70 cm. long, and could therefore just take super royal paper (*c.* 70×50 cm.).

We cannot be certain of the details of the printing presses of the sixteenth century, since they were never closely described and none appear to have survived. Nevertheless they probably did not differ much from the later common presses, for the sixteenth-century illustrations of printing presses (mostly poor and repetitive woodcuts used as printers' devices) suggest only one substantial peculiarity: this was a spindle and screw which appears in a few early cuts to have been made of wood (though other cuts, equally early, show presses with metal spindles and screws).[3]

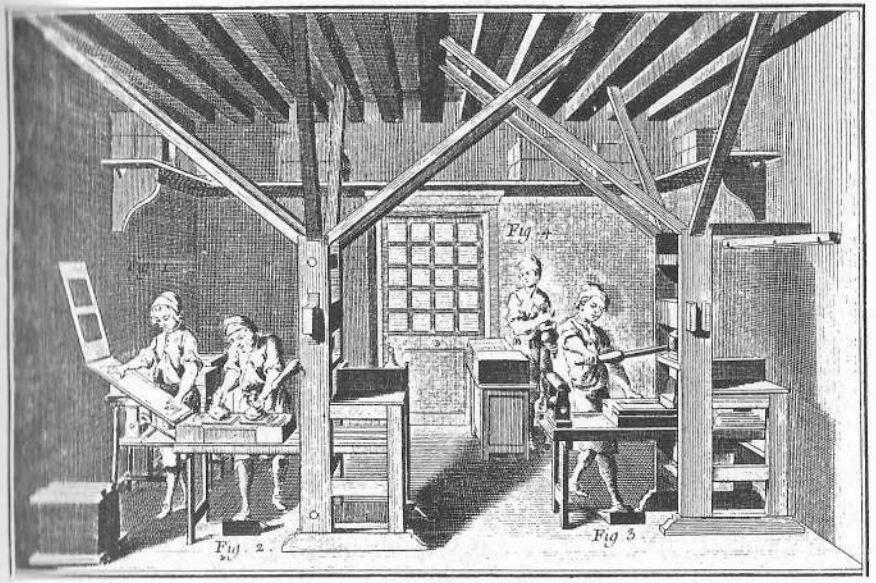

FIG. 67. A French press-room of the mid eighteenth century. The presses, which are braced to the ceiling, have windlasses in the gallows for tightening the girths but, unlike Fertel's press of 1723, they have no head-bolts, the head tenons simply being packed in the mortises. The puller on the left is changing the paper as his beater inks a folio forme. The puller on the right is pulling the first half of his forme, while the beater distributes the ink on the balls, stepping back at the same time to overlook the heap. (*Encyclopédie*, planches vii, Paris 1769, 'Imprimerie en caractères', pl. 14.)

[3] The principal illustrations are collected in Enschedé, J. W., 'Houten handpersen in de zestiende eeuw', *Tijdschrift voor boek- en bibliotheekswesen*, iv, 1906, pp. 196–215.

The difference between a press with a wooden screw and one with a metal screw was important because the former was able to develop little more than half the power developed by the latter from an equal pull on the bar; this was because of the greater diameter and greater frictional losses of the wooden screw.[4] However it is not necessary to suppose that wooden press screws preceded steel ones. Steel press spindles, with brass nuts cast on the screws, were within the technological capacity of (for instance) mid-fifteenth-century Mainz, and a press with a wooden screw may have been built in a place that lacked an advanced metal technology rather than at a particularly early date.

PREPARING THE PAPER[5]

The heap of printing paper was first set out for the pressmen by the warehouse-keeper, who normally took it from a batch of paper that had been bought for the particular book that was being printed (see p. 142). He removed the cording quires from the paper-maker's reams (the quires made up of more or less imperfect sheets, which he would later sort for usable paper) and arranged the good quires, still folded in half, into tokens of 250+ sheets up to the total number of tokens required for a sheet of the edition (or, if the edition were very large, up to the number required for a day's work). These tokens were to be the pressmen's units of work, and there was a strong tendency for edition sizes to be exact multiples of 250. The additional sheets over 250 were put into the heap for use as proof-, tympan-, and register-sheets, and to cover accidents at press. The allowance of extra sheets for these purposes was very small—it varied slightly with the edition size, but was typically about 3 per cent—which helps to explain why so many imperfect sheets, and even lightly-corrected press proofs, were included in completed books.

The warehouse-keeper would put slightly imperfect paper, such as the better sheets culled from the cording quires, into the heaps for the middle sheets of the book, where it would be less obtrusive than at the ends (the grossly imperfect sheets were put by and sold). Remnants of paper from batches bought for other books, if they were of the right size and quality, might be put in anywhere.

The heap was given to the pressmen the day before it was to be used,

[4] A common press with a steel screw and a brass nut, mean diameter x and coefficient of friction y, develops about 1·8 times as much thrust at the toe of the spindle from a given pull at the bar as a similar press with a wooden screw and nut, mean diameter $2x$ and coefficient of friction $2y$. (Thrust $\simeq \frac{E(\frac{R}{r})}{\tan\theta+\mu}$, where E is the pull on the bar, R the length of the bar, r the mean radius of the screw, θ the angle of incidence of the thread, and μ the coefficient of friction.)

[5] Moxon, J., op. cit., pp. 320–2, 278–81.

so that they might wet it and leave it to stand overnight under a heavy weight. The quires were drawn one by one through a pan of water, unfolded, and laid out flat on a board one on top of another, a sheet being folded down to mark each token. Paper had to be wetted in order to secure a good colour on the printed sheet, for there was not enough power available in the common press—only about 2·25 kg./cm² over the area of the platen even though it covered only half the forme at a time[6]—to force the fibres of dry rag paper to take ink evenly and fully.

Next morning the heap, now damp right through, was set up on one end of the horse (later called the bank), a bench long enough to take two piles of paper end to end, and about as high as the coffin of the press. In the sixteenth century the horse was placed on the far side of the press, parallel to the ribs, but in the seventeenth and eighteenth centuries the more usual position was on the near side, set out at slightly less than a right angle from the fore-end of the ribs.

INK[7]

Printing ink was constituted of two parts, varnish and colour, which were manufactured separately and then combined to make ink. The varnish was the liquid vehicle, or medium, in which the colour was conveyed to the surface of the type and thence to the paper. There the varnish 'dried'—it was really a complex process of oxidation and solidification rather than simple evaporation—and bound the colour to the paper.

Varnish was made of old nut or linseed oil, reduced by boiling, with the addition of a small quantity of resinous material to prevent it from spreading sideways into the paper and causing unsightly stains. The colour for the black ink was a lampblack obtained by condensing the smoke of burning resin, which was then calcified by heating to remove residual tars which might also have been a cause of staining and discoloration, and finally ground to an extremely fine powder. For red ink the usual colour was ground vermilion (i.e. red mercuric sulphide).

The earliest printers, and especially Gutenberg and Schoeffer, made superb black inks, rich and pure in colour and free of any tendency to stain, which have proved to be entirely stable. From then on there was a decline in quality and, although there was always a considerable difference between the best inks in use and the worst, no printer managed to make or acquire an ink as fine as Schoeffer's until after the end of the hand-press period. There can be little doubt that the decline was caused by the fact

[6] A common press gave a thrust of about 3,160 kg. at the toe of the spindle from a pull on the bar of 68 kg.; see p. 124 n. 4 for the formula.

[7] Bloy, C. H., *A history of printing ink, balls and rollers, 1440–1850*, London 1967.

that good ink cost three or four times as much to make as bad. Printers of the hand-press period were chronically short of work, and competed by cutting costs; with no market for a really fine ink, the art of making it was forgotten. Baskerville tried very hard to find a notably good ink in the mid eighteenth century, but he failed.

Ink was being manufactured and sold by specialist firms in France in the earlier sixteenth century, and Plantin of Antwerp, who bought his ink ready-made by the ton, sold a consignment of ink to an Edinburgh printer in 1581.[8] But, while much printing ink was made and traded by specialist ink-makers throughout the hand-press period, some printers continued to make their own ink—or at least some of its constituents—until well into the nineteenth century.

Ink was worked up for use on the ink-block of the press (a small table mounted behind the near-side cheek) and transferred to the surface of the type by one of the pressmen using a pair of ink balls.[9] These were leather pads 15 cm. in diameter, mounted in wooden cups and handles and stuffed with wool or horsehair. The ball pelts, which were usually sheepskin, were fixed to the handles with nails which were only lightly knocked in, and were removed after the day's work (and often during the midday break as well). This was so that the stuffing could be teased out and cleared of lumps, and so that the pelts could be softened by currying and soaking them in urine; the smell is said to have been revolting. The amount of stuffing in the balls was varied to suit the nature of the work; large, soft balls with weak ink were used for low-grade work; small, hard balls and strong ink for work of better quality.[10]

Rollers for inking were not developed until after the end of the hand-press period, but they would have made little difference to the operation of the common press. A forme could be inked with balls as fast as the press could be worked, and the ordinary journeyman printer could wield them skilfully enough: bad inking, unlike bad ink, was never common. When balls were compared with rollers in the nineteenth century, their chief disadvantage was seen to be their cost: they were relatively uneconomical of ink, and they involved a considerable regular outlay on the materials of their construction, especially pelts.

MAKING READY[11]

While one of the pressmen was busy with ink and balls, the other received one or both formes for a sheet from the compositor, together with the final

[8] Bloy, C. H., op. cit., p. 66; Voet, L., *The golden compasses*, ii.
[9] Moxon, J., op. cit., pp. 282–91.
[10] Savage, W., *Practical hints on decorative printing*, London 1822, p. 24.
[11] Moxon, J., op. cit., pp. 263–77.

proof, and prepared the press for printing the first forme. Which forme this was could depend either on the compositor (if only one forme was delivered at a time) or on the pressmen (if both were delivered). In England there was a strong tendency to print the inner forme first, although it was not an invariable rule. In a representative sample of 200 English books of the seventeenth and eighteenth centuries, 73 per cent of the sheets (which numbered over 2,500 in all) were found to have been printed inner forme first, the periods of greatest regularity in the respect being 1641–1700 (90 per cent printed inner forme first) and 1701–50 (86 per cent).[12] Foreign practice has not been investigated in similar detail, but the early manuals suggest that German printers preferred to start with the outer forme;[13] and that French printers may also originally have preferred to print the outer forme first but that by the mid eighteenth century they were normally printing the inner forme first.[14]

A reason for printing the inner forme first may have been that it could be imposed before the last page of the outer forme was set. Alternatively the reason may have been that it prevented page 1 from being marred by a deep impression of page 2 showing through from behind, for it ensured that page 1 was printed last. (Perhaps it was also for reasons of appearance that there was a similar though less marked tendency in England to print the outer forme on the felt side of the paper, which was not so obviously ribbed as the mould side, and made a better show of page 1.)[15]

The orientation of the formes on the bed of the press in England was with page 3 (or, in the outer forme, page 1) next to the platen in folios and octavos, and with the same pages away from the platen in quartos and duodecimos.[16] In France and Germany, quarto formes were oriented like folios and octavos with pages 3 or 1 towards the platen, and only duodecimos had pages 3 or 1 away from the platen.[17] It was necessary to have rules so that the second forme should not be laid on the wrong way round, although it may be wondered why all impositions were not treated in the same way as duodecimo, of which the orientation was fixed by the placing of the points for the offcut. (The format diagrams, pp. 88–105, show the printed sheet on the open tympan, not the forme; the pages next to the platen during printing are on the right, those away from the platen on the left.)

[12] Povey, K., 'Working to rule, 1600–1800: a study of pressmen's practice', *The Library*, xx, 1965, pp. 13–54.
[13] From Hornschuch, H., op. cit. (1608), onwards.
[14] Fertel, M. D., op. cit. (1723), gives the inner forme as the *retiration* in his imposition diagrams, but the *Encyclopédie* (viii, 'Neufchastel' 1765, p. 617) says that the inner forme (*le côté de deux et trois*) was normally printed first.
[15] Povey, K., op. cit. [16] Moxon, J., op. cit., p. 239.
[17] According to the imposition diagrams in the manuals; Fertel, for instance (op. cit., pp. 140ff.), clearly indicates the orientation with a pair of 'fists'.

The pressman's first task with a new book was to make register, which meant laying on the first forme relative to the bed of the press and the press points so that, when the paper was printed on one side, turned over, and replaced on the points, the pages of the second forme would fall square on the backs of those of the first. Since the two formes were (or should have been) closely similar to each other, it was only necessary to find the right position for one of them. In a process which need not be described in detail,[18] the pressman established the positions of the (probably standard) furniture and quoins against which his standard chases would be locked up, and adjusted the press points on the tympan.

The pressman chose long-shanked points for small paper, short-shanked points for large; and in impositions other than duodecimo they were fixed at each side of the tympan half way between its ends. The near-side point was placed further in towards the middle of the tympan (and of the sheet) than the off-side point. This guarded the pressmen against the accident of the sheet being turned over from side to side rather than from end to end, for in that case the point holes would locate it in an obviously wrong position on the tympan.

In duodecimo impositions the points could not be placed half way between the ends of the tympan because there were pages in the way. They were therefore placed one third of the way from the frisket end of the tympan, and formes were oriented so that the division for the offcuts came under the points. With the points away from the centre of the sheet, it had to be turned over from side to side, and they were therefore placed an equal distance in from the edge; it was of course impossible in this case to turn the sheet over mistakenly from end to end and still use the same point holes.

The proper positions for the formes and the points being fixed, a sheet of paper from the heap was pasted to the face of the tympan where it served as a guide to positioning the sheets on the tympan during the printing of the first forme; this was the tympan sheet.

The tympan parchment was thoroughly wetted for work, and a woollen blanket, folded in two, was placed as packing between the outer and the inner tympan. This ensured that the type would dig well into the damp paper, so that there was no need for the make-ready of the machine-press period, whereby tissue overlays were pasted on to the tympan to compensate for worn type. Blocks, which tended to be less than type-high, were commonly underlaid with paper or card.

Next came the frisket. If the frisket frame was newly covered, an impression of the forme was pulled on it, and the printed areas were cut out with a knife. The grid that remained (corresponding to the furniture of the

[18] Moxon, J., op. cit., pp. 264–8.

forme) would both hold the printing paper against the tympan when it was folded down on to the type, and protect it from being dirtied by anything on the bed of the press beyond the margins of the pages. Each press was equipped with several frisket frames, and a frisket cut for any standard format would be kept for re-use; hence the practice of making them with parchment, rather than—as later—with brown paper. Standard friskets could then be modified for use with particular formes, patches being pasted or sewn on where there were blank pages, and thin pieces of wood attached to the patches to act as bearers, preventing the platen from dipping into the blanks.

Finally the forme was checked for odd pieces of type lying on it, in danger of being picked up by the balls and deposited on a page; the stays for tympan and frisket, the bar-catch, footstep, etc., were adjusted to the pressman's liking; the heap was positioned on the horse; and everything was ready to begin printing.

Make-ready sounds a lengthy process, but with a press in going order and ordinary impositions it could be carried out very quickly; press crews could change formes, and even books, in a matter of minutes.

PULLING AND BEATING[19]

The two pressmen took it in turns to pull on the bar and beat the forme, the senior man generally making the press ready and taking the first turn as puller, while the other knocked up the balls and prepared the ink. The length of the turn was so many tokens of 250 sheets printed on one side, the number in the seventeenth century being commonly three or six. Each token so printed was conventionally supposed to represent one hour's work but, as we shall see, not all formes could be printed at the same rate.

The beater moved his balls over the forme with a rocking motion while the press was open. The rest of the time he distributed the ink over the surface of the balls by turning and rolling them against each other, taking up a dab of ink every two or three sheets, and simultaneously looking over the last-printed sheet as it lay on the horse to see that it had no obvious blemishes and that he was maintaining a good colour with his inking (fig. 67).

Meanwhile the puller lifted a sheet of clean paper from the heap and laid it on the tympan in line with the edges of the tympan sheet. Then he lowered the frisket on to it (which pressed it on to the points) and folded tympan, paper, and frisket together down on to the forme. Next, taking the handle of the windlass (the rounce) in his left hand he gave it one full turn anti-clockwise, thus running the rear half of the forme back under

[19] Moxon, J., op. cit., pp. 289–99.

the platen. Keeping his left hand on or near the rounce, he grasped the crooked bow of the bar with his right hand, drew it towards him while slipping his hand along to its end, and ended with one strong straight pull.

The movement of the bar turned the spindle through about ninety degrees, and the screw working in the nut caused it to descend about 15 mm. Taking the hose with it, the spindle forced the platen down on to the back of the rear half of the tympan, which in turn pressed the paper on to the rear half of the inked forme, pressure being achieved between the nut in the head of the press, which could not rise, and the carriage supported by the winter, which could not descend. The packing between the tops of the head tenons and their mortises had some elasticity and this, combined with the elasticity of the tympan blanket and of the whole wooden frame of the press, then forced the screw to move back into the nut, turning the bar back to the off-side cheek after the pull and raising the spindle to its original position; and, since the hose moved up and down with the spindle, and the platen was lashed to the hose, the platen was lifted clear of the tympan. Visitors would be surprised by the loud creaking and groaning of the presses as the timbers gave and rubbed against each other.[20]

The amount of elasticity in the mechanism of the press could be much reduced. A printer who wanted to achieve a sharp impression from unworn type of even height-to-paper would put hard rather than soft packing in the tympan, and he would use incompressible packing in the head mortises to intensify the effect of the pressman's pull by bringing it up with a jolt. Plantin described the pressmen pushing the bar back on to its catch after the pull, rather than allowing it to spring back;[21] and Baskerville took particular care to use hard packing in his tympans.[22]

The puller then gave the rounce another half turn anti-clockwise to bring the second half of the forme under the platen, and pulled again. Finally, resting the bar on its catch on the off-side cheek, he gave the rounce one and a half turns clockwise to run the carriage right out again. He raised tympan and frisket in one flowing movement, lifted the new-printed sheet off the points, and laid it on the horse at the end of the unprinted heap; then turned immediately to laying on the next sheet. At 250 sheets an hour, the whole cycle was repeated every 14–15 seconds.

If a forme contained type in one half only—as did, for instance, a folio forme with one page blank—the bar was only pulled once for each impression, which eased the puller's task slightly. In the eighteenth and early nineteenth centuries small formes with type areas smaller than the platen

[20] Hansard, T. C., *Typographia*, London 1825, p. 416n.
[21] [Plantin, C.], *Dialogues*, Anvers 1567, pp. 246–7.
[22] *Signature*, xii, 1951, p. 45.

were occasionally imposed sideways across the bed of the press, and the paper (which might theoretically be as large as demy, but was probably smaller) was laid sideways across the tympan; in this way the whole forme was printed at one pull. The use of this method is indicated by point holes at the ends, rather than at the sides, of the sheet.[23]

Presses were sometimes worked by a single pressman, who beat the forme and pulled alternately. In this case, which was called working at half press, his rate of work was rather less than half that of the normal crew of two. Pressmen sometimes employed boys (called devils or flies) privately by the week to take printed sheets off the tympan, and thus speed up their rate of work.[24] Such aid would have been especially valuable to a man working at half press, and indeed it probably explains how one of the pressmen at Cambridge, working alone in 1700, achieved an output considerably greater than half the maximum rate achieved in the same printing house by crews of two pressmen (p. 140).

PRINTING THE REITERATION (OR PERFECTING)[25]

Having printed the sheets of the heap on one side, the pressmen turned it over (from side to side for duodecimo, otherwise from end to end), and changed the first forme for the second. The register was tested, and any necessary adjustment was made by shifting the second forme slightly on the bed of the press. The reiteration was then printed off in much the same way as the white paper, the sheets going through the press in the same order as before. The chief difference was that the puller located the paper on the tympan by fitting the point holes over the points.

The tympan sheet, no longer needed as a guide to the alignment of the sheets, was replaced by a linen cloth, which was less likely than paper to take set-off (ink marks) from the impressions of the first forme; but if set-off did occur and threatened to set back and spoil subsequent impressions of the first forme, the tympan cloth could be rubbed over with lye to clean it. Protective set-off sheets of waste paper were inserted by hand printers of the nineteenth century between sheets of the reiteration and their dry, hard-packed tympans, and were changed as often as necessary; and a few printers of the hand-press period preferred this device to the use of a soggy tympan cloth.[26]

[23] Foxon, D. F., 'On printing "at one pull", and distinguishing impressions by point-holes', *The Library*, xi, 1956, pp. 284–5; the method may also have been used in the fifteenth century (*Studies in bibliography*, xxiii, 1970, p. 144). Not to be confused with the 'inverted' impositions described on pp. 106–7, which may also show point-holes at the ends of the sheet.
[24] Moxon, J., op. cit., p. 338.
[25] Moxon, J., op. cit., pp. 297–8.
[26] Early-seventeenth-century set-off sheets are used as endpapers in two bindings in Trinity College Library, Cambridge (D. 5. 25 and D. 11. 38).

The early accounts agree that the heap was turned over, and the reiteration printed, immediately after the printing of the white paper. Indeed the printer would be unwilling to leave the heap for long with only one side printed, for the paper would begin to dry and shrink—or would be liable to change shape differentially if it had to be redamped—so that it became impossible to fit the point holes over the points and make register. Exactly how long is uncertain, but experiment with a damp cloth over a heap suggests that it could be kept for no more than two or three days without distortion.

The sixteenth-century account of Le Roy suggests that the heap was normally printed as white paper in the morning, turned at the midday break, and perfected in the afternoon.[27] If this was indeed the usual practice it may be supposed that, if the whole edition of a sheet could not be printed and perfected in one day (either because it exceeded the normal day's work, defined in the same account as 1,250–1,300 perfected sheets, or because work on a smaller number of sheets was begun late in the day), part of it would have been printed and perfected on one day, and the remainder on the following day; and that this would result in the second forme of the first day's work being left on the bed of the press to become the first forme of the second day's work. Such a procedure offers to explain some puzzles in early books, as when some copies of a particular sheet are found to have been printed inner forme first, while other copies of the same sheet were printed outer forme first; or as when patterns of progressive stop-press corrections to both formes of a sheet are found in several copies in combinations that are incompatible with it having been printed in a simple, consecutive way.[28] (It has been supposed that such situations resulted from 'concurrent perfecting', on the hypothesis that two presses started work simultaneously on the same sheet, one printing the inner forme and the other the outer, and that they exchanged heaps—or would it have been formes?—half way through.[29] But there is no early evidence for any such practice; concurrent perfecting would always have been difficult to fit into the normal complexity of work flow in a printing house with two or more presses, and if it happened at all it is unlikely to have been more than an exceptional resort in cases of urgency when the speed of two-press operation was necessary.)

Although the sixteenth- and seventeenth-century accounts of printing suggest that it was usual to print both formes of a sheet at a single press—

[27] *The Library*, x, 1955, p. 41.

[28] McKenzie, D. F., *The Cambridge University Press 1696–1712*, Cambridge 1966, i, p. 128; *The Library*, iv, 1949–50, p. 247.

[29] The hypothesis is discussed by K. Povey in *The Library*, x, 1955, pp. 43–8.

and this was certainly the normal practice at the Cambridge University Press at the end of the seventeenth century—it ceased to be normal in English printing of the eighteenth century. The detailed records of Bowyer's business show a clear preference for printing the two formes of a sheet consecutively at two different presses in the 1730s,[30] and the evidence of press figures confirms that Bowyer's practice was the normal one from the 1720s until the end of the century.

PRESS FIGURES[31]

From the late seventeenth until the end of the eighteenth century, British pressmen sometimes set an arabic figure or other symbol at the bottom of a page of the forme they were about to work off; they would put it in any page that did not already have a signature in it. The earliest known examples of press figures date from the 1680s, but at first the practice was relatively uncommon. Some 10 per cent of English books were figured in the 1690s, and 25 per cent from 1700 to 1720; up to this time the figures were more often symbols, such as asterisks, than numbers. Then from 1720 until 1800, a majority—some 60 per cent—of English books were figured, now usually with numbers; a few books were figured in Scotland and Ireland, and in America,[32] but the practice was unknown elsewhere.

Press figures appear to have been used for two very different purposes. One, which may have been the earlier and may have been connected with the use of symbols or letters rather than numbers, was to enable pressmen to identify their own work, probably so that they could keep a check on their wages. The other, for which the evidence is later in date (it appears to coincide with the practice of consecutive perfecting at different presses), and which may have been connected with the use of numbers as figures, was to enable the master to identify the pressmen's work so that he could penalize individuals in cases of bad workmanship. In the first case the pressman voluntarily put his mark on the sheets he printed; in the second the master compelled his pressmen to mark their work with the number by which their press was known, fining them if they failed to do so.

It is clear from the correlation of the figures in particular eighteenth-century books with the relevant printers' records that press figures of both sorts were used with considerable irregularity. The pressman who marked his own work for his own purposes at Cambridge in 1701–3 did not figure all the formes he worked, and he used sometimes one symbol, sometimes

[30] McKenzie, D. F., 'Printers of the mind', *Studies in bibliography*, xxii, 1969, p. 20.

[31] The best general account (from which the percentages in this paragraph are taken) is Povey, K., 'A century of press figures', *The Library*, xiv, 1959, pp. 251–73; it includes references to earlier papers.

[32] Tanselle, G. T., 'Press figures in America', *Studies in bibliography*, xix, 1966, pp. 123–60.

another.[33] In Bowyer's printing house in the 1730s pressmen sometimes failed to figure a forme, and sometimes they figured it with a wrong press-number.[34] When the Cambridge pressman printed both formes of a sheet, he only figured one of them; but when Bowyer's men printed both formes of a sheet they generally figured both, and an unfigured forme might have been printed at any press. Finally, the highest press number in a series does not necessarily indicate the number of presses actually in use; often there were fewer presses at work than the number suggest, and there is also the possibility (though there is little evidence for it) that very high numbers —the figure '22' has been recorded[35]—may have referred to pressmen, not presses.

CANCELS, ETC.[36]

Errors discovered after a sheet had been printed could be corrected (if it was thought worth it) in various ways. Of these the simplest was to print a list of errata at the end of the book or amongst the preliminaries; and the most radical was to destroy all the copies of the sheet, reset it and reprint it. Whole sheets were undoubtedly cancelled in this way on occasion, but they are usually difficult to identify unless an uncancelled copy of the sheet happens to survive. Differences in the paper of a cancelled whole sheet may give a clue, but the warehouseman might at any time put out small remnants of paper left over from printing other books so that paper evidence by itself seldom gives a clear indication of whole-sheet cancellation. (But the first 28 sheets of Baskerville's Virgil of 1757 were printed on an unprecedented wove paper, and the rest, plus a number of whole-sheet and single-leaf cancels, were printed on laid paper, so that whole-sheet cancels on laid paper show up in the wove part of the book.[37]) Evidence of whole-sheet cancellation may sometimes be found in the running titles of the headlines. There was generally considerable regularity in the use of skeleton formes through a hand-printed book (see pp. 109–10), and whole-sheet cancellation was very likely to interrupt the pattern, often to the extent of introducing a special set of headlines.

The cancellation and replacement of individual leaves (or occasionally of conjugate pairs of leaves) was much cheaper than whole-sheet cancellation, and it became very common, especially during the eighteenth century. The method usually employed was to reset the text of the leaf to be cancelled and to print a new leaf (together with any other cancels) on a spare

[33] McKenzie, D. F., 'Printers of the mind', *Studies in bibliography*, xxii, 1969, p. 51.
[34] Ibid., pp. 52, 70–4.
[35] In Piozzi, H. L., *Observations on a journey*, 2 vols., for Strahan and Cadell, 1789, ii, p. 162.
[36] Chapman, R. W., *Cancels*, London and New York 1930 (still the best general account).
[37] Gaskell, P., *John Baskerville a bibliography*, Cambridge 1959, pp. 19–22.

section of a later sheet of the book—typically a sheet of preliminaries—or even on a sheet of another book of similar format. (The leaf that was to be cancelled is nowadays called the cancellandum, plural cancellanda, and the leaf that was to replace it is called the cancellans, plural cancellantia.) After the sheet that was to contain a cancel had been folded, the cancellandum was cut out close to the inner margin and thrown away, and the cancellans was pasted on to the stub.

Most cancellantia are easy to identify. The stub of the cancellandum (not to be confused with the stubs of such things as inserted plates) is often visible; and occasionally a cancellans will have been inserted like a plate so that *two* stubs are visible. Sometimes cancellantia were marked with a symbol such as an asterisk, or they may show aberrant running titles, signatures, or press figures; again, cancellantia may have extra or missing lines of type, or they may not line up exactly with the other pages of the sheet. If none of these signs appear, the paper will usually give cancels away: even if cancellantia are printed on paper of the same thickness, quality, and colour as that of the rest of the sheet, the patterns of chain-lines, watermarks, and (if the book is uncut) edges will practically always be interrupted by cancellation. Finally, a few copies of an edition seem generally to have slipped through with their cancellanda uncancelled, so that examples of the original settings may sometimes be found (occasionally slashed by the warehouse keeper's shears or cut with a knife, deliberate defacement which escaped notice).

Comparison of cancel leaves with their uncancelled originals shows that the errors thus corrected were sometimes trivial. Baskerville's four-volume Ariosto of 1773 had a total of sixty-six cancelled leaves, most of them correcting no more than a single letter of the Italian text;[38] and on several occasions in the 1750s and 1760s Rousseau's publisher Marc-Michel Rey wrote to encourage the author to use up the blank leaves of final sheets for printing cancels.[39]

Other methods of correcting sheets after printing were overprinting by running the sheet through the press again; overprinting by stamping inked type by hand on to each copy of the sheet; printing corrections on slips of paper and pasting them over the errors; and amending the mistakes in each copy in manuscript.[40] Sometimes several sorts of correction are found in a single book: a work by Augustine Vincent printed by Jaggard in 1622

[38] Gaskell, P., op. cit., pp. 61–3.
[39] 'Comme il y a 4 pages de blanc a la derniere feuille voulez vous que j'y fasse des cartons?' (Rey to Rousseau, 23 Oct. 1760, concerning the printing of *La nouvelle Héloïse; Correspondance complète de Jean Jacques Rousseau*, ed. Leigh, R. A., vii, Genève and Madison 1969, p. 264).
[40] Tillotson, G. and A., 'Pen-and-ink corrections in mid-seventeenth-century books', *The Library*, xiv, 1933–4, pp. 59–72.

contained a list of sixty-one errata, seven cancelled leaves, four slips pasted in, and a line overprinted by running a sheet through the press a second time; its title (happily enough) was *A discovery of errors* (S.T.C. 24756).[41]

SPECIAL PAPER[42]

It was not uncommon throughout the hand-press period for a fraction of an edition of an important or expensive book to be produced in a way that marked it off from the ordinary copies; thus there might be an issue on large paper, thick paper, fine paper, or coloured paper, or on some other material such as vellum, linen, or silk. The special copies might be intended for presentation, or they might be sold at a higher price than the ordinary copies. Special issues were seldom embellished with typographical changes (such as additional page borders) until the nineteenth century, but the special sheets were sometimes distinguished by symbols such as asterisks; technically they may be 'states', not 'issues' (see pp. 315–16).

When the papers or other materials used for different issues of a book were of different sizes, it was necessary to adjust the margins of 8°, 12°, and small formats by altering the amount of furniture between the pages in the formes. In the later part of the period special issues were sometimes imposed for a folding other than that used for the ordinary issue; thus the same pages might be imposed in 8° for ordinary paper and (with more ample margins) in 4° for large paper. In such cases it would probably be more convenient to work with separate sets of skeletons (apart from head- and direction-lines), one set for each issue.

There appears to have been no firm rule as to whether the special-paper copies should be printed before or after the ordinary ones, both practices having been identified. Presswork is better at the end of a run than at the beginning, but on the other hand the type is least worn at the beginning.

Special issues on vellum were especially characteristic of fifteenth- and early-sixteenth-century printing, when they usually cost about three times as much as the ordinary copies on paper;[43] indeed there was a vellum issue of the very first printed book, the 42-line Bible. Coloured-paper issues became common in Italian printing of the sixteenth century, the earliest examples being three Aldine editions of 1514 with special copies printed on blue paper.[44] The special issues of the seventeenth and eighteenth

[41] Wood, E. R., 'Cancels and corrections in *A discovery of errors*, 1622', *The Library*, xiii, 1958, pp. 124–7.

[42] There is no general account of special-paper copies, but a large number of particular eighteenth-century examples are detailed in Gaskell, P., *A bibliography of the Foulis Press*, London 1964.

[43] Haebler, K., *The study of incunabula*, New York 1933, repr. New York 1967, p. 187. But Plantin's copies on vellum cost eight times as much as copies on paper (Voet, L., *The golden compasses*, ii).

[44] Weiss, W., 'Blaues Papier für Druckzwecke', *Gutenberg Jahrbuch*, 1959, p. 30.

centuries were usually on large or fine paper, sometimes folded differently from the ordinary copies. A few printers made a particular feature of their special issues: Plantin put out his great polyglot Bible (Antwerp 1569–72) on four different sorts of paper and on vellum; while a Foulis Press *Iliad* (Glasgow 1747) was issued in foolscap 8°, Greek and Latin; pot 8°, Greek and Latin; foolscap 8°, Greek only; pot 8°, Greek only; foolscap 4°, Greek only; pot 4°, Greek only; and vellum 8°, Greek only.[45]

TWO COLOURS; AND MUSIC

Printing a second colour, usually red, alongside the black is as old as printing, but it has always been considerably more expensive than printing in black alone and has remained uncommon except in Catholic service books. The earliest printers experimented with printing two (or occasionally more) colours at a single impression, which gave perfect register between the black printing and the red but which meant that both black and red ink had to be applied to the type between each impression.[46] The only really satisfactory way of doing this was to take the type that was to print red out of the forme (normally isolated initials and words), ink the red type and the black type separately, and then replace the red type, between each impression; for if both the inks were applied with all the type locked together in the forme, even with the careful use of masks, the red type inevitably became contaminated to some extent with black ink.[47]

Unlocking the forme to remove and replace the red type between each impression was inevitably very slow, and by the beginning of the sixteenth century two-colour printing was normally done by means of two impressions to each side of the sheet, which was much quicker even though the register between black and red was never quite so good. Two-impression colour printing could be done either red first or black first, and surviving colour proofs of the sixteenth century suggest that the red-first method (fully described by Fertel in 1723)[48] may have been the earlier.[49]

If the red was to be printed first, the whole forme was set up, red and black type together, and proofed, often in red ink; and the parts that were to be printed in red were underlined on the proof. A new parchment frisket was prepared and lined with paper (in order to prevent it from sagging and

[45] Voet, L., *The golden compasses*, ii; Gaskell, P., *A bibliography of the Foulis Press*, London 1964, no. 84.

[46] Masson, I., *The Mainz psalters and canon missae 1457–1459*, London 1954, pp. 25–30.

[47] Haebler, K., op. cit., pp. 127–34.

[48] Fertel, M. D., *La science pratique de l'imprimerie*, Saint-Omer 1723, pp. 277–83.

[49] L.2086-1937 in the Victoria and Albert Museum Library is a red colour-proof and L.2848-1937 is part of a red colour-frisket; several other early colour proofs and friskets are known. Plantin normally printed red first (Voet, L., *The golden compasses*, ii).

biting when it got damp during the run), and an impression of the forme was pulled on it in red. Guided by the marked proof, the pressman then cut rectangular holes in the frisket where the red type was to print through, and he pasted the resulting patches of parchment and paper on to the face of the tympan precisely in line with the holes in the frisket from which they were cut. Next the heap was printed off with red ink, the patches on the tympan giving extra impression to the red type, and the frisket protecting the paper from being marked by the rest of the type. The colour frisket was then discarded (several used colour friskets have been found in sixteenth-century bindings) and an ordinary frisket was fitted. The red type was removed from the forme, the holes being filled with quads and spaces, and the sheets were run through the press again, this time being printed in black from the rest of the forme. Finally the patches were cleared off the tympan, a new colour frisket was fitted and the whole process was repeated for the other side of the sheet.

The black-first method of colour printing, described by Moxon in 1683, was essentially similar.[50] The whole forme was proofed, and the colour frisket pulled, in black ink. The red type was then removed from the forme, the spaces being filled with quads, and put aside, together with the colour frisket. Using an ordinary frisket the heap was printed off in black. Next the colour frisket was cut out, but this time the patches were put into the forme as underlays for the red type, which was now put back and locked up. (It was obviously not essential to put the frisket patches under the red type; they could just as well have been stuck to the tympan as in Fertel's red-first method.) Finally the red type was printed off, using the colour frisket to protect the parts of the sheet already printed in black.

There seems to have been very little to choose between the two methods. If the black were printed first there was no need to prepare and handle red ink before the actual run; and Fertel suggested that it was quicker to paste frisket patches on to the tympan than to use them as underlays.

The whole performance of sticking the frisket patches on the tympan (or of underlaying the type with them) could be avoided if specially tall type, above standard height, were used for setting the red part of the forme. Such special type was introduced at the Plantin-Moretus house in about 1680; and French regulations of 1723 specified that tall type intended for printing in red should be marked with a special nick.[51]

Music,[52] too, was printed in the late fifteenth and early sixteenth centuries

[50] Moxon, J., op. cit., pp. 299–300.

[51] Voet, L., *The golden compasses*, ii; Veyrin-Forrer, J., 'Aperçu sur la fonderie typographique parisienne au xviie siècle', *The Library*, xxiv, 1969, pp. 209–10.

[52] For the bibliography of music printing, see p. 396.

by double impression, the staves (lines) being printed at one impression and the notes at another. Single-impression music type began to appear in the late 1520s, each piece of type bearing a note (complete with stem if it had one) and sections of the stave, made so that the stave lines joined with the lines of the adjacent pieces of type. This sort of single-impression type was limited to reproducing simple music, however, and from the 1580s the more sophisticated music that was then beginning to be written was increasingly printed from plates. Engraved copper plates were used at first; then from the early eighteenth century pewter plates, both punched and engraved, replaced copper; and finally from the second quarter of the nineteenth century there was a great outpouring of music printed from lithographic plates and stones. Music printing from movable type continued alongside plate printing, and was brought to maturity in the 1750s by J. G. I. Breitkopf, whose music type consisted of small, standard-sized type units about the size of a note head, with which a complex score—staves, notes, stems and all—could be built up piece by piece, in the same way as complex decorative designs could be built up with printers' flowers.

Special copies for presentation and the like might be embellished with a few words printed in gold, but this was done by hand, not by the normal two-colour method. Words to be printed thus were set up and locked tight in a composing stick. The face of the letters was then 'inked' with a colourless varnish, and the stick was turned over and pressed by hand on to the right place on the sheet. Gold leaf was laid down over the varnish impressions of the type, where it adhered; the varnish quickly dried, and the surplus leaf was rubbed off, leaving only the forms of the letters gilded.[53]

OUTPUT

The output of pressmen during the hand-press period, like that of compositors, did not in practice conform to any theoretical norm. The token of 250 sheets printed on one side was conventionally called an hour's work, but this figure was at best a mean: a large forme of small type took longer to print than a small forme of large type, and there were besides formes to change and make-ready (which slowed up the printing of a small edition more than that of a large one) and occasionally such extras as printing in two colours. In fact the rate of work achieved was usually less than 250 impressions per hour, or 3,000 impressions per 12-hour day, though it is impossible to generalize further. The maximum possible rate for emergencies was considerable: rates in the region of 400–450 impressions

[53] Moxon, J., op. cit., pp. 301–2.

per hour were achieved in the early nineteenth century with frequent changes of pressmen.[54]

During one week in 1700 a team of two pressmen at the Cambridge University Press pulled a total of 20,700 impressions, or an average of 3,450 impressions a day; but then later in the same year another press team (including one of the same men) produced the following successive weekly averages of impressions per day: 2,534; 2,300; 1,616; 2,116; 1,784; 2,834; 1,566; and so on. The difference between the maximum average of 3,450 impressions per day and the minimum average of 1,566 involved a factor of more than 2, and the rates fluctuated rapidly between wide limits. Similar variation characterized work 'at half press' (i.e. when a press was worked by a single journeyman). The Cambridge pressman who was the common member of the two teams mentioned above also worked by himself for several successive weeks in 1700, when his daily averages of impressions were 1,034; 1,766; 1,100; 2,034; and 1,208. Again there was a factor of about 2 in the difference between his highest and his lowest rates, and again there were abrupt fluctuations in his output from one week to the next (though it will be remembered that a pressman might employ a boy to help him, which probably explains the extraordinarily high half-press rate of 2,034 impressions a day).[55]

Records of wages paid at other printing houses during the hand-press period, both in Britain and abroad, all tell the same story: there was always a wide variation from week to week in the amount of work actually done by pressmen, just as there was in the amount done by compositors—and no doubt for the same reasons (see pp. 54–6).

During the earlier hand-press period—up to about the middle of the seventeenth century—pressmen in England, France, and the Low Countries seem generally to have contracted with their masters to print a certain number of impressions per day or per week for a fixed wage, the actual number printed fluctuating to a certain extent, and the wage varying with the difficulty of the work, and probably also with the amount of work available or the amount the journeyman wanted to do (a system similar to that of the compositors' piecework contracts, pp. 55, 173).[56] The contract number in England was usually 2,500 or 3,000 impressions a day; Plantin's pressmen contracted for 2,500 impressions; and French contracts were similarly in the range 2,500–3,350 impressions per day.[57]

[54] This with ink balls and (probably) Stanhope presses (which were not much faster than wooden two-pull common presses); *Notes and queries*, 4th ser., iii, 1869, p. 486.

[55] McKenzie, D. F., *The Cambridge University Press 1696–1712*, Cambridge 1966, i, chs. 3, 4; idem, 'Printers of the mind', *Studies in bibliography*, xxii, 1969, pp. 7–22.

[56] McKenzie, D. F., op. cit. (1969), p. 11 and n. 18.

[57] Moxon, J., op. cit., pp. 327–8; Hinman, C., *The printing and proof-reading of the first folio of Shakespeare*, Oxford 1963, i, p. 42; Voet, L., 'The making of books in the renaissance', *Printing and graphic arts*, x, 1966, pp. 48–9; Febvre, L., and Martin, H. J., *L'apparition du livre*, Paris 1958, p. 199; Martin, H. J., *Livre, pouvoirs et société à Paris au XVII^e siècle*, Genève 1969, i, p. 376.

By the end of the seventeenth century pressmen were contracting for a price per token—i.e. piecework payment for the number printed—heavy work being paid up to 75 per cent more per token than light work, with extra payments made for such jobs as altering the margins for large paper, or for printing in two colours.[58] During the eighteenth century a less flexible scale was adopted in England, whereby a flat rate per token was paid regardless of the difficulty of the work.[59]

Plantin's pressmen earned slightly more than his compositors up to about 1580, after which the situation was reversed. French pressmen of the sixteenth and seventeenth centuries earned as much as 40 per cent more than ordinary compositors, but in English printing houses of the later seventeenth and of the eighteenth centuries it was the other way round, the compositors earning almost half as much again as the pressmen.[60] By this later period pressmen in England were despised as mere 'horses', the 'great guzzlers of beer' who were rebuked by the young Benjamin Franklin for their mindless intemperance.[61]

[58] McKenzie, op. cit. (1966), i, pp. 85–7. Alteration of margins, printing in two colours, etc., also affected the standard rates of charges to customers (Strahan ledgers).

[59] Philip, I. G., *William Blackstone and the reform of the Oxford University Press in the eighteenth century*, Oxford 1957, p. 30.

[60] Voet, L., *The golden compasses*, ii; Febvre, L., and Martin, H. J., op. cit., p. 200; McKenzie, D. F., op. cit. (1966), i, pp. 83, 90; idem, op. cit. (1969), pp. 67–70.

[61] Franklin, B., *The life*, ed. Bigelow, J., London 1870, i, p. 160.