*Trinity College, Cambridge,* Cambridge, 1876 ; W. Th. Lowndes, *Bibliographers Manual,* ed. by Henr. G. Bohn, London, 1S58, &c. ; J. C. Brunet, *Manuel du Libraire,* Paris, 1860(four earlier editions); Th. F. *Dibdin, Bibliotheca Spenceriana,* London, 1814, &c., and his other works ; Ennen, *Katalog der Incunabeln in der Stadt-Bibliothek zu Köln* ; Schoepflin, *Vindiciæ Typog.,* 1760; Meerman, *origines Typog.,* The Hague, 1765 ; Dupont, *Hist. de l'Impr.,* Paris, 1869 ; Firmin-Didot, *Hist. de la Typog.,* Paris, 1882; E. Duverger, *Hist. de I’Invention de l'Impr.,* Paris, 1840 ; P. Lambinet, *Origine de l'mpr.,* Paris, 1810 ; Ch. Ruelens, *La Légende de St Servais,* Brussels, 1873, 8vo ; J. P. A. Madden, *Lettres d'un Biblio­graphe,* Paris, 1868-78; Wetter, *Krit. Gesch. der Erfindung der Buchdrucker­kunst,* Mainz, 1836 ; A. de Vries, *Êclaircissemens sur l’Histoire de l’Inv. de l'Impr.,* The Hague, 1843 ; Jos. Ames, *Typogr. Antiquities* (augmented by W. Herbert), London, 1785-90; T. C. Hansard, *Typographia,* London, 1825; Thomas, *Hist. of Printing in America,* Albany, 1874 ; Th. L. Devinne, *The Inv. of Print.,* London, 1877 ; W. Skeen, *Early Typography,* Colombo, 1872 ; Sam. Palmer, *A General Hist. of Print.,* London, 1732 ; W. Young Ottley, *Inquiry concerning the Inv. of Print.,* London, 1863 ; Henry Bradshaw, *A Classified Index of the 15th Century Books in the Collection of the late Μ. J. de Meyer,* London, 1870; Id., *Hist. of the Founts of Type and Woodcut Devices used by Printers in Holland in the Fifteenth Century,* London, 1871 ; Id., *The Printer of the Historia S. Albani,* Cambridge, 1868 ; A. Von der Linde, *Haarlem Legend,* London, 1870 ; Id., *Gutenberg,* Stuttgart, 1881; Id., *Gesch. der Erfind. der Buchdruckerkunst,* Berlin, 1886 ; Schaab, *Gesch. der Erfind. der Buchdruckerk.,* Mainz, 1830; K. Falkenstein, *Gesch. der Buchdruckerk.,* Leipsic, 1856 ; Lorck, *Handb. der Gesch. der Buchdruckerk.,* Leipsic, 1882 ; K. Faulmann, *lllustr. Gesch. der Buchdruck­erk.,* vienna, 1882 ; Μ. Denis, *Wiens Buchdruckergesch. bis 1560,* vienna, 1782; C. R. Hildeburn, *A Century of Printing—The Issues of the Press in Pennsylvania, 1684-1784,* Philadelphia, 1887 ; and J. Garcia Icazbalceta, *Bibliog. Mexicana del Siglo XVI.*, Mexico, 1887. The titles of other works on the invention, progress, and process of printing, &c., may be learned from the lists of books on such subjects in the works already quoted. (J. H. H.)

Part II.—Practical.

Printing has been defined to be the act, art, or practice of im­pressing letters, characters, or figures on paper, cloth, or other material, the definition being based on the etymology (Old Fr. *empreindre,* from Lat. *imprimere).* Technically the same definition might be applied to such arts as those of calico and oilcloth print­ing, and even of moulding, embossing, coining, and stamping ; but in point of fact these are never understood when the word “printing” is employed. There is also printing without pressure, such as photographic printing. The use of a pigment or ink must be regarded as an indispensable element. The application of the term is therefore confined to the use of pressure and a pigment for literary and pictorial purposes. As thus defined, printing includes three entirely different processes—not inaptly called the polygraphic arts—viz., chalcography or copperplate printing (compare Engrav­ing, vol. viii. p. 439 *sq.),* Lithography *(q.v.*) or chemical stone­printing, and typography or letterpress printing. The last-named is that to which the present article is confined.

The difference between the three methods lies essentially in the nature or conformation of the surface that is inked, and which afterwards gives a reproduction or image in reverse on the material to be impressed. In copperplate printing the whole of a flat sur­face is inked, and a portion of the ink sinks into an incision or trench, in which it still remains after the surface is cleansed. When pressure is brought to bear, this ink is transferred to the paper, giving an impression of a line. In lithographic printing the flat surface is protected except at certain places, where it is slightly coated with the ink, which practically leaves the stone quite level, but also marks a line when pressure is brought to bear. In typography the printing surface is in relief. It alone receives ink, the remainder being protected by its lower level. Any kind of printing done from a relief surface belongs to letterpress print­ing, such as a woodcut, a casting in metal, india-rubber, celluloid, xylonite, &c. (or “stereotype”), or a deposition by electricity (or “electrotype”). The typographic method requires a surface that is more difficult to form than either of the other two. In litho­graphy the surface may be obtained by merely writing or drawing on the stone ; in copperplate printing the line may be immediately incised into or scratched on the plate ; but for letterpress printing the surface between the lines in relief has to be cut away. Hence the tediousness of wood-engraving, in which all the surface of the block has to be removed except those parts that are to be printed from and which form the black lines in the impression ; and the conformation of a type surface is similar.

Typography, however, has many compensating advantages. Im­pressions are taken with much greater facility. The inking appli­ance glides over the relief lines to be printed from, whereas it would cling to the entire surface of the stone or the metal ; hence much greater pressure would be required in these cases. The unprintable part of the stone in lithography has to be damped, so as to repel the ink ; the same portion has to be inked and then cleaned off in copperplate printing ; but in letterpress printing the ink only that has to be transferred to the paper needs to be applied to the type. When the design has been drawn on the stone or scratched into the copper, the result does not admit of any further application beyond that at first contemplated. But in letterpress printing the surface may be of a composite character. It may be formed of single pieces representing the several letters, and these, when once formed, may be employed in endless combinations. Only by such means are cheap newspapers and books possible. Before the in­vention of typography (as in the East to the present day), the dif­ferent pages of a book were printed from wooden blocks, cut after the manner of a wood-engraving. Blocks of this kind are of no use for printing after their first purpose has been fulfilled. They must necessarily be made very slowly and with much labour. In forming a page of a book, on the other hand, by the typographic method there need (excluding necessary wear and tear) only be the cost of “composing” the types and of “distributing” them into their proper receptacles, from which they may be re-taken many times to form other compositions.

*Types : their Material Characteristics.*

Exclusive of such printing surfaces as wood-blocks and casts, the letters, marks, and signs with which letterpress printing is executed are called *types,* a proportioned quantity of each of the letters of the alphabet in any one body or face forming a *fount.* A book­work fount contains single letters, diphthongs, ligatures (such as ff, fl), accented letters, figures, fractions, points, reference marks, dashes or metal rales (as―), leaders (as......), braces (z—l—.),

and signs (as &, £). It also includes quadrats,—pieces of metal of various widths, which do not print, but are used to compensate for the shortness of occasional lines, as at the close of a paragraph— and spaces, which separate words and letters. There are thus about 226 separate characters in every ordinary English book-work fount. The table used by type-founders to regulate the number of each of the several sorts in a fount is called a *bill of type.* The sorts are supplied by English type-founders in certain definite proportions, depending upon the number of lower-case m’s. A bill of 3000 m’s usually contains the following :—

|  |  |  |  |
| --- | --- | --- | --- |
| Lower-case. | Figures, &c. | Capitals. | Small Caps. |
| m ... 3,000 | , ... 4,500 | A ... 700 | A ... 450 |
| a ... 9,000 | ; ... 800 | B ... 450 | B ... 270 |
| b ... 2,000 | : ... 600 | C ... 500 | c ... 350 |
| c ... 4,000 | . ... 3,000 | D ... 550 | D ... 350 |
| d ... 5,000 | - ... 1,000 | E ... 750 | E ... 450 |
| e ... 14,000 | ? ... 300 | F ... 450 | F ... 300 |
| f ... 3,000 | ! ... 200 | G ... 450 | G ... 270 |
| g ... 2,000 | ’ ... 800 | H ... 450 | h ... 300 |
| h ... 6,000 | ( ... 400 | I ... 900 | I ... 450 |
| I ... 9,000 | [ ... 200 | J ... 300 | J ... 200 |
| j ... 500 | \* ... 250 | K ... 300 | κ ... 200 |
| k ... 800 | † ... 100 | L ... 550 | L ... 300 |
| l ... 5.000 | Î ... 100 | M ... 650 | M ... 300 |
| n ... 8,000 | § ... 100 | N ... 550 | N ... 350 |
| o ... 8,000 | II ... 100 | O ... 550 | o ... 350 |
| p ... 2,400 | ⁋ ... 70 | P ... 500 | p ... 270 |
| q ... 600 |  | Q ... 200 | Q ... 120 |
| r ... 7,000 | 1 ... 700 | R ... 500 | R .... 330 |
| s ... 8,000 | 2 ... 600 | S ... 600 | s ... 350 |
| t ... 10,000 | 3 ... 600 | T ... 800 | τ ... 420 |
| u ... 4,500 | 4 ... 500 | U ... 350 | u ... 240 |
| V ... 1,500 | 5 ... 500 | V ... 350 | V ... 200 |
| w ... 2,500 | 6 ... 500 | W ... 550 | w ... 270 |
| X ... 500 | 7 ... 500 | X ... 200 | X ... 120 |
| y ... 2,500 | 8 ... 500 | Y ... 350 | γ ... 200 |
| z ... 300 | 9 ... 500 | Z ... 150 | z ... 120 |
| & ... 300 | 0 ... 700 | Æ ... 100 | æ ... 60 |
| ff ... 400 | £ ... 200 | Œ ... 100 | œ ... 60 |
| fi ... 500 |  |  |  |
| fl ... 300 | é ... 200 | *¼ ... 150* | spaces. |
| ffl ... 200 | à ... 200 | *⅜ ... 150* | Thick 20,000 |
| ffi ... 300 | â ... 100 | ¾ ... 150 | Middle 8,000 |
| æ ... 200 | ë ... 100 |  | Thin 8,000 |
| œ ... 100 |  | ⅛ ... 50 | Hair 3,000 |
| — ... 500 | All other 100 | ⅔ ... 50 | Em qds. 3,000 |
| ―... 150 | accents | ⅛ ... 50 | En qds. 6,000 |
| 100 | each | ⅜ ... 50 | ,—'—, ea. 20 |
| 80 | &, p, lb, 50 | ⅝ ... 50 | — 25 |
| 100 | each | ⅞ ... 50 | z——- 25 |
| 100 | ... 30 | ⅙ ... 50 | , ' × 25 |
| Large quads, o | ne-tenth of fount | Italic, one-tf | ;nth of Roman. |

Such a fount would weigh about 750 lb if of pica size, 480 lb if long primer, 400 lb if bourgeois, 330 lb brevier, 280 lb minion, 220 lb nonpareil. The numbers of the respective letters are based on the requirements of the English language;@@1 other languages of course require different proportions. In Latin and French, for instance, q and u would be deficient, h in excess, and w needless. The number of the respective letters may be, and sometimes is, appor­tioned by weight ; for example, in one of the “ schemes” of founts

@@@1 There is a tradition in one of the oldest English foundries that this scale originated in a laborious calculation of the comparative number of different letters used in setting up a lengthy debate in the House of Commons, it being supposed then that the purest English was spoken there. The scale is, however, frequently found defective in practice. It is a curious fact, for instance, that the matter of Charles Dickens’s works will empty the vowel boxes long before those of the consonants, and that Lord Macaulay’s statelier style will run with like persistency on consonants.