that is, of a pica m,—the square of the depth of pica. As the latter is one-sixth of an inch, the em is the same width,' and a page of twenty-four ems wide is equal to one 4 inches wide. The columns of this *Encyclopaedia* are 19 ems wide.

According to the purpose for which they are used, types are divided into two classes—book type, including Roman and Italic, and job type, including a multitude of fanciful forms of letters, chiefly founded on the shape of the Roman and Italic letters, and intended to be more prominent, delicate, elegant, &c. It is im­possible to enumerate all the varieties of the latter class, as addi­tions are being constantly made and once popular styles always going out of fashion. The leading varieties are the antiques, which are Roman letters with strokes of nearly uniform thickness, as M ; sanserifs or grotesques, which have no serifs, as M ; blacks, as ; and scripts, which represent the modern cursive or Italian hand­writing, as Black letter is now only a jobbing type in English- speaking countries, although, as stated in the historical section of this article, it was the first character used in printing. It is still used in Germany, with certain modifications, as the principal text­letter for books and newspapers. A comparison of the numerous reproductions that have been issued of Caxton’s works with any modern line of black letter will show how greatly the form and style have been altered within a period of four centuries. The present style of Roman type dates only from about the first quarter of the 18th century. Previously the approved shape was as follows :—

The use of this type was revived by Whittingham of the Chiswick Press about 1843, and it has since become a favourite form, under the name of old style. Some of the punches cut by the first notable English type-founder, William Caslon (1692-1766), have been pre­served and types are being constantly cast from them. Nearly all founders now produce modernized old style. For the recent revival of old style printing, see p. 710 below.

Large letters, such as are employed for large bills and posters, are made of wood, chiefly rock maple, sycamore, pine, and lime. These are cut up, planed to the required size, and then engraved, generally by special machinery, this being a business quite dis­tinct from that of letter-founding. The larger letters are designated as two line, three line, four line, &c.,—meaning twice, thrice, or four times the depth of face of pica or great primer, &c.

Type metal is an alloy, of which lead is the principal ingredient ; but, owing to its softness, antimony and tin are added (see vol. ii. p. 129 and vol. xiv. p. 378). A patent type metal (Besley’s) was invented in 1855 in which the mixture consisted of lead, regulus of antimony, tin, nickel, copper, and bismuth. Nearly all type is now made with some of these metals superadded. Ductility, hard­ness, and toughness are the prime requisites of a type metal.

The earliest printers made their own types, and the books printed from them can now be distinguished with almost as much certainty as handwriting can be identified. The modern printer has recourse to the type-founder. The first step in the making of type is cutting the letter on the end of a piece of fine steel, forming the punch (see fig. 2), which is after­wards hardened. This is an operation requir­ing great care and nicety (there being comparatively few adepts at it), in order that the various sorts in a fount may be ex­actly uniform in width, height, and general proportions to each other. A separate punch is required for each character in every fount of type, and the making of them is the most expensive branch of type-founding. During the pro­cess of its manufacture the punch is frequently tested or measured by delicate gauges to insure its accuracy. When finished it is held over a light, the flame of which blackens the letter, and thus enables an impression, called a *smoke proof,* to be stamped on paper. When the letter is perfect, it is driven into a piece of polished copper, called the *drive* or *strike* (fig. 3). This passes to the justifier, who makes the width and depth of the faces uniform throughout the fount. They must then be made to line exactly with each other. When completed, the strike becomes the matrix (fig. 4), wherein the face of the type is made. This method of making a matrix has until now been in almost universal use in Great Britain. It is, however, a very slow and costly process. In America the great majority of matrices are made otherwise. If the design of the fount to be produced is original, it is often cut by hand or by an engraving-machine on the piece of metal which is to form the matrix. If, on the other hand, an existing fount has to be copied, the matrix is made by electro-deposition. A perfectly good type is selected, and inserted in a mould specially made, called a *fusible mould* (fig. 5). Sufficient metal of a more fusible nature than the type is cast round it, and forms a shape similar to that of the ordinary mat­rix. This fusible cast is then placed in a box pro­tected by glass and gutta­percha, in order that the copper deposit may be kept square and to the proper dimensions. This arrangement also limits the deposition to the face. The box is immersed in the copper electrotyping solution, in which it may be left until the deposit of metal has increased to a thickness at which it

may be backed up with copper, or it is left until it reaches the full thickness, which is about 5/16 of an inch. It is then fitted in line, set, position, and height. The minutest imperfection or blemish is reproduced by the deposition, and the type cast from such a matrix is a perfect counterpart of the original. A school of type-engravers has recently sprung up in the United States, cutting exclusively on metal and producing ornamentation and finish which the punch-cutters cannot rival. It is expected that in the course of time the electrotype matrix will nearly supersede that made in the old-fashioned way with the punch. In the ordinary method the mould in which the body of the type is formed is made of hardened steel in two parts ; one part is fastened to the machine and is station­ary, while the other is movable so that it may be adjusted for the proper width of the letters, as one is wider than another. The com­bined matrix and mould are then adjusted to the type-casting machine, which manufactures types at the rate of from 25 to about 120 per minute, according to the body. The metal is kept fluid by a little furnace underneath and is injected into the mould by a pump, the spout of which is in front of the metal pot. The mould is movable, and at every revolution of the wheel it comes up to the spout, receives a charge of metal, and flies back with a fully formed type in its bosom ; when the upper half of the mould is lifted, a type is ejected. The spring in front holds the copper matrix in close proximity to the mould. The letter a, for instance, stamped in the matrix is directly opposite the aperture in the mould which meets the spout of the pump. When a due proportion of a’s are cast, another matrix with b stamped on it takes its place, and so on throughout the whole fount. The types, however, are not finished when they leave the machine. There will be found attached to each a wedge-shaped *jet* (fig. 6), somewhat similar to that on a bullet cast in a hand-mould. These are picked off by boys at the rate of from 2000 to 6000 per hour. A burr which still adheres to the shoulder of the type is taken off by the rubbers, who rub the sides on circular stones or on files. The types afterwards go to the setters, who arrange them in long lines ready for the dresser, and he slips them into a long stick, turns them on their face, and, after duly fastening them, cuts with a plane a groove in the bottom, which forms the feet. (These processes are now frequently performed by a machine, which produces types that do not require rubbing or dressing.) The types are then dressed and the picker takes them in hand, in order to pick out each defective letter with the aid of a magnifying glass. They are finally made up into parcels of a convenient size, called *typefounders’ pages,* weighing about 8 lb each.

Subjoined is a description of a machine for performing automa­tically the various operations of casting and finishing type which was invented about twenty years ago by Messrs J. R. Johnson and J. S. Atkinson. In this apparatus the metal is fused, injected into the mould, the cast letter turned out, rubbed or planed, first on one side and then on the other, the feet cut out and smoothed, the dressed sides planed alternately, and the finished letter set up on a stick ready for use by the printer. The casting machine and the dressing machine are in reality distinct, though mounted on a com­mon frame. The whole is driven by a steam-engine or other prime mover. The casting machine consists of a furnace covered by a shallow pot holding the fused metal. In this is a pump, and the mould is placed opposite its nozzle. The mould being adjusted and the matrix in its place, the molten metal is injected and then solidifies, forming a perfect type, but with jet attached. This letter is then thrust out, and the mould closes again for another jet of molten metal. All this is effected by one revolution of the axle of the machine. The letters pass through a channel one by one into the dressing machine. On arriving there they have each of their sides planed in succession by being held against cutters. When one side is made true with respect to the set of the letter on