ground of economy with any possible mechanical arrangement. On the other hand, employers and makers of machines allege that owing to the opposition of the men machine type-setting has not had fair play. However that may be, it is undeniable that a composing machine is still rare in printing offices, and where employed it is only as an auxiliary to the ordinary labour of the men. It deserves to be mentioned that nearly the whole of the *Times,* with the single exception of the advertisements, has for years past been set up by machinery, and that more than 10,000 pages of the present edition of the *Encyclopaedia Britannica* have also been so set up. We have not space to describe with any minuteness the construction of composing machines. In the Fraser machine (fig. 8), one of the simplest of its class, which has been made use of to the extent already mentioned in the present work, the types are contained in a series of grooved trays A, in the upper part of the machine, the trays having previously been filled by complementary apparatus called the *distributor.* In these trays the types are kept in position, and pressed to­wards the front part of each tray, by slips of metal at­tached by cords to the box­wheels B ; each of these con­tains a spring of sufficient strength to press the line of

types steadily forward against the separators C, which are formed with an inverted shoulder, under which the front type in each line passes. The keys are connected by levers to the separators, and the depression of any key causes the corresponding separ­ator to descend, carrying with it the front type of the line into the grooved face-plate, down which it slides into the com­posing stick G. Immediately the finger is lifted from the key the spiral spring D raises the separator to its original position, and the next type in the line takes the place of the one just released, and so in succession as fast as the keys can be pressed. Under the keys runs a rod connected by a crank motion with the pusher G, which, with every depression of a key, pushes forward the line of type in the composing stick, thus making room for the next letter. The matter is thus set in one continuous line, ready to be divided into lines of the required length either by the operator at the machine or by another hand working in conjunction. The speed of the machine varies from 6000 to 12,000 types per hour, but is regulated solely by the skill of the operator, as the machine will work as fast as the keys can be pressed. The composing machines now employed at the *Times* office are an improved form of an apparatus invented by Charles Kastenbein, and introduced there in 1872. The oper­ator sits in front of four rows of keys one above the other, something like the manuals of an organ, but only about 3 feet wide. Each of the keys corresponds to a type or character. The types are kept in tin tubes placed vertically at the top of the machine. The de­pression of a key works a series of levers, and an iron finger pushes the undermost type from its tube, when it falls into a groove formed in a conducting plate, narrowing at the bottom to its apex. Imme­diately below is a receptacle, and by the action of a treadle the type is pushed along a channel. Other letters follow, the matter being thus set up in a long line, on a groove of the width of an em quad, and running from left to right. The type when it first comes into the groove is in an upright position, but in passing along it becomes twisted, so that the letters stand at an angle of about 45o when they reach the point at which they are justified. This groove com­municates at its dexter extremity with the justifying galley,—a simple apparatus, something of the nature of a composing stick and galley combined. Then the type is divided into portions or lines of the required length and justified in the galley, which is adjustable to the width of the required length. As the long line approaches him, the justifier with a small bodkin accelerates a portion large enough in his judgment to fill the width of his column. When this is done he presses his foot on the treadle under him, and thereby causes the line to be pushed into the galley. The line is justified by spaces and quads, and enough type is then taken for another line. The speed depends on the operator, and varies from 6000 to 13,000 types per hour, the average being about 8000, with two operators,—a justifier and a compositor being also necessary. These machines are worked in the *Times* office at the rate of a column of solid minion an hour. The machine occupies a floor space of only about 4 feet wide by 2 deep.

Another machine at present in use is that of Mr Robert Hattersley of Manchester. It probably furnished the general scheme of others in use. One of the most ingenious machines of the kind is that of Mr Alexander Mackie of Warrington, its general principle being the adoption to setting up types of the Jacquard card of the power loom, which weaves automatically the most intricate patterns of cloth. The apparatus consists of three parts,—two used for pre­paring the “card” or ribbon, which directs the third in the opera­tion of type composing. The perforator is like a small cottage pianoforte. When the keys are struck they produce a perforation, and the ribbon is made to move aside a little, so that a new surface may be presented for puncturing. The composer is a circular iron table, 4 feet in diameter, having round its periphery a number of boxes divided into sections, each of which holds one kind of type. On a slightly lower plane is a wheel carrying little brass tables, hinged at one end. When the machine is in motion, the types are pushed out on to the table, which passes with its freight round its course until it comes to the point of delivery, when the types are swept off. The rising of the table, and the drawing out of the types, are guided by the perforated paper. Hence the machine sets types without a human compositor. When once the ribbon is perforated, it may be used over again for subsequent editions of the same work, which may be in a different size of type. These machines are only in use in the office of the inventor.

As has been already described under Reporting (vol. xx. p. 406), the parliamentary reports of some newspapers are set up entirely without copy,—by the ear, not by the eye. It has been found that by the aid of the machine the matter can be set up half as fast again as it could be written out : the average speed of the compos­ing machine is 230 lines per hour when the copy is dictated to the operator, whereas the most skilful workman setting at ease in the usual way can do but 50 lines per hour.

For many years it was a favourite idea with inventors, especially those who were not practical printers, that great economy might be gained in composition by the use of word-characters or “ logotypes,” instead of single letters. The constant repetition of many words seemed to suggest that they might be cast in one piece. Combina­tions suitable for affixes and suffixes, as ad-, ac-, in-, -ing, -ment, &c., it was also suggested, should be used instead of the single component letters. The suggestion has, however, not been carried out, at least to any considerable extent. The chief practical objection to it is that it involves the use of cases with an inconveniently large num­ber of boxes. The more the variety of characters is multiplied the more “travel” of the compositor’s hand over the cases is necessary for picking them up, and by so much is the speed of his work re­tarded. Logotypes, too, are more liable to accident ; when one letter is damaged the combination is rendered useless.

The correction of the type is a subject that should be understood by all who have to do with printing, as many mistakes are made on the part of authors which a little technical knowledge would prevent. In the course of setting any *copy* or MS. which may be given him the compositor unavoidably picks up some wrong letters, or mistakes the words in the copy before him, or fails to follow the style prescribed for the work. These are called *printer's errors.* When the compositor has finished his task, a first proof of the matter is taken. This proof is read through and compared with the copy by the proof reader or *corrector of the press* and an assist­ant, the *copy-holder* or reading boy. The proof is then sent back to the compositor and the latter is required to correct all the inac­curacies indicated therein—in fact, to attend to all the directions given by the reader—and this has to be done at his own cost if he is working on piece—that is, paid by results according to work done —or by the employer if he is working “ on establishment wages ” or paid by time. Another proof called a *revise* is now taken ; this is carefully compared with the previous proof. If the corrections have not all been made, the revise is marked accordingly, and sent back to the compositor, who is required to remedy the imperfec­tions. When the proof is deemed accurate, or “ clean,” it is sent, generally along with the copy, to the author,—being now termed an author’s proof. Finally, in the printing office the matter is carefully re-read and compared with the last author’s proof by the press reader, who signs it and on his responsibility the type is printed off.

The operation of distributing the types is the converse of that of composing : it is de-composing the forme and returning the several letters to their proper boxes in the case. It is done, as already mentioned, with remarkable rapidity. The forme is first washed over with an alkaline or other detergent to remove the ink from its surface, and then laid down on the imposing surface, unlocked, and damped ; this assists the cohesion of the type, after the chase, furniture, side sticks, &c., are removed. The compositor then takes in his left hand, supported by a setting rule, a portion of type in lines, and with the right hand takes a word or so between the finger and thumb, letting each letter drop separately into its proper box. There is hardly any operation which so strikes a spectator as dis­tributing, for a competent distributor literally showers the types into their receptacles. The types are held upside down, that is, with the nicks uppermost ; hence the letters of each word are read from left to right like ordinary matter when printed, but the words are of course dealt with in the inverse order.

Distributing machines of many different kinds have been invented.