covered about an inch thick with a composition of glue and treacle or of glycerin or other substance. The ink is spread out with a palette knife or similar appliance on a table adjoining the press, and by repeatedly re­volving the roller over it, it becomes coated with an extremely thin film of ink. The roller is then moved over the surface of the forme on the press, until sufficient ink has been trans­ferred to it. This is called *rolling,* and is a very important part of press-work, for if inefficiently per­formed there will be too much ink on

the impres­sion, or even blotches, which are called *monks,* or the print will be too pale or grey in places, such im­perfections being called *friars.* The sheet of paper to be printed is next laid on the tym­pan, to pins serving as guides. The frisket is folded down on the tympan, which is in turn folded down on the forme with the right hand, while with the left the handle is turned and the press carriage brought under the platen. The bar is pulled by the right hand, the handle turned the reverse way with the left hand, the carriage brought out again, the tympan raised, the frisket opened, and the printed sheet removed, the tympan being ready to receive another white sheet. The frisket serves, among other things, to keep the edges and parts of the sheet not required to be printed from being discoloured by contact with the ink or the sides of the forme, and to aid in steadying the sheet when the tympan is depressed and in the removal of the sheet when it is raised. Such is a bare outline of the method of printing at a hand-press,—one necessarily imperfect from a technical point of view, but sufficient to indicate the essentials of the operation.

Another press which has been much used is the Columbian,—a name given to it by its inventor, Clymer, an American. The power is gained by an ingenious combination of levers. Two of these are connected by a rod with the bar handle, which is in itself a lever. The platen is attached to the head by a strong iron bolt, the descent being made steady and regular by vertical guides. It is counterbalanced by a powerful lever or beam, having an adjust­able weight shaped like an eagle, which raises it automatically. In the bar handle is a screw stop by means of which the length of the lever rod can be adjusted and its pressure, or the *pull,* per­fectly regulated.

Nine distinct processes have thus to be gone through in order to print one side of a sheet of paper at a hand-press :—(1) inking the roller, (2) inking the forme, (3) laying the sheet on the tympan, (4) folding down the tympan, (5) running in the forme under the platen, (6) taking the impression by depressing the platen, and then immediately afterwards allowing it to raise itself by means of the counterpoise or spring, (7) running out the forme, (8) lifting the tympan and frisket, and (9) removing the sheet. The object of successive improvers of the printing press has been to render the apparatus more automatic, or to substitute for it a “ machine ” that will reduce these nine operations to the minimum. In modern machines this has been effected to the extent of rendering necessary only three of them—(1) laying on or “feeding” the sheets, (2) applying the motive power, (3) taking off or delivering the sheets ; and rotary machines both feed and deliver themselves auto­matically. Nearly all cylinder machines have a delivery apparatus, and quite recently an appliance for the automatic feeding to them of single sheets of paper has been invented.

With respect to the platen press we notice first that which is capable of being driven by a rotating shaft or wheel. It should be observed that the adoption of the rotatory principle was essential to the acceleration of speed. This was recognized by the projector of the machine@@1 press, William Nicholson, and by Frederick Koenig, who first brought the invention into use and constructed a practical

press. The essential arrangements of every machine are four, their respective objects being (1) to feed in the paper, (2) to ink the forme, (3) to print the sheet, and (4) to deliver or take it off.

The treadle platen press is the simplest of machine presses capable of being worked by a wheel. When other motive power is not available it is driven by a treadle, like that of a lathe. The type forme is usually secured by clamps on an almost vertical bed (fig. 11), and the platen rocks backwards and forwards, being thus brought in contact with the type on the bed. Just before the impression is taken, the two surfaces are mo­mentarily parallel. The inking is effected by small composition rollers, ad­justed in a roller carrier swinging on a pivot. The rollers receive ink from a “fountain” or duct of ink at the top of the machine, below which is an arrangement, such as a revolving disk, for dis­tributing the ink. The constant motion of the rollers and of the revolving ink disk is equivalent to the manual movements of the operator who “ rolls ” at the hand-press. The rollers are carried by self-acting appliances over the face of the forme, and return to the ink table to be replenished with ink, after which the impression takes place. The sheet to be printed is placed in proper position on the platen, which is covered with paper or parchment, and is secured there during the move­ment of the platen by movable fingers called *grippers.* The platen on advancing brings the paper in contact with the type forme ; after the printing it returns to its original position, when the sheet is removed and another sheet adjusted ready for being printed. The treadle platen press is only adapted for work on paper of small size, up to half sheet demy, but within this limit it is greatly superior to the hand-press. If sufficiently strong and well built, it gives a far more powerful impression, and it occupies about a sixth of the space. Its great merit, however, is its superior speed. The hand-press, when worked by two men, one rolling the types and one pulling the handle of the press, produces only about 250 impressions per hour. The treadle press is worked by a boy, who has only to depress the treadle with his foot, and lay on and take off the sheets with his hands, and he can work at the rate of more than 1000 per hour. The treadle press is also superior to the hand-press in the uniformity of its results, since the automatic inking ensures a greater regularity in the colour of the impressions than with the old hand-inking process.

The ordinary or ‘ ‘ double ” platen press was, in principle, very similar to the hand-press. It was about 13 feet long. The platen, in the centre, was massive, as the machine printed sheets as large as double demy, and it had a perpendicular motion, being guided in grooves and worked by a connecting rod fixed to a cross beam and crank, which acquired its motion from the main shaft. In other respects the machine differed from the hand-press in having two type beds or coffins and two inking tables arranged at the ends of the carriage, which travelled backwards and forwards, being worked by a drum underneath. The paper to be printed was laid to marks on the frisket, and this was hinged on the tympan, which in turn was fastened to the end of the coffin by hinges or joints. The frisket and tympan were opened by running up bars at suitable positions. After a newly printed sheet was removed, another was placed on the frisket, which as the carriage moved ran down the bars and closed on the sheet, which then received its impression. This arrangement was dangerous to the boys who had to lay on the sheets.

Formerly it was thought that the very finest printing could not be done by a cylinder impressing a forme in the progress of its re­ciprocating motion, for that was liable to slur or blur the im­pression. Hence platen presses were employed for the best work. Of recent years engineers have brought the cylinder press to such perfection that there is not the slightest danger, under the super­intendence of a capable man, of any slur. Working quite as well as the platen press, the cylinder press is enormously quicker and more productive ; it requires less driving power ; and much better inking is obtained, which is all-important for fine woodcut print­ing. Accordingly, for even the best illustrated book-work, the platen power-press is now almost entirely superseded by the cylinder.

Cylinder machines are of two kinds,—(1) presses in which the type is on a flat plane and (2) those in which the type, or more correctly the impressing surface, is cylindrical. The first are called *cylinder* presses, the second—a development of the first—the *rotary* web presses.

The simplest kind of mechanical press is called the single-

@@@1 The best account of its invention is contained in a series of articles by Mr william Blades in the *Printers' Register,* 1883-S4, and Th. Goebel’s *Friedrich Koenig und die Erfindung der Schnellpresse* (Stuttgart, 1883). This last has been translated into French by Paul Schmidt, *F. Koenig et l'Invention de la Presse Mécanique* (Paris, 1885).