A is the cast iron pressure cylinder; B the lapping with which it is usually wrapped; C the engraved copper printing roller; D the steel “cleaning doctor”; E the brass “lint doctor”; F the colour-furnishing roller; G the colour-trough or “box” in which the latter (F) works partly immersed in colour; X an endless woollen blanket continually circulating between the cloth to be printed (K) and the cylinder A; and K the cloth in question. In operation, the cylinder A is screwed down with an even pres­sure into frictional contact with the roller C; the machine is then set in motion, turning in the direction indicated by the arrows; the cloth is now introduced between A and C and as it leaves the machine fully printed it is carried over a series of drying cylinders situated above and heated by steam. The printing roller C is the only part of the machine directly connected with the motor or main drive of the works through the cog-wheel on its axle— the "mandril ”—all the other parts deriving their motion from *it,* either by friction as in the case of the cylinder or by a spur wheel as in that of the colour-furnishing roller. The mode of printing is almost self-evident; the roller C revolving in the direc­tion of the arrow takes colour from the “ furnisher ” F, the excess is scraped off by the “ doctor ” G and, in continuing its course, it comes in contact with the cloth K, which being pressed by the cylinder A into the engraving abstracts the colour therefrom and of course receives an exact impression of the engraved pattern.

Larger machines printing from two to sixteen colours are pre­cisely similar in principle to the above, but differ somewhat in detail and are naturally more complex and difficult to operate. In a twelve-colour machine, for example, twelve copper rollers, each carrying one portion of the design, are arranged round a central pressure cylinder, or bowl, common to all, and each roller is driven by a common driving wheel, called the “ crown ” wheel, actuated, in most cases, by its own steam-engine or motor. Another difference is that the adjustment of pressure is transferred from the cylinder to the rollers which work in specially constructed bearings capable of the following movements: (1) Of being screwed up bodily until the rollers are lightly pressed against the central bowl; (2) of being moved to and fro sideways so that the rollers may be laterally adjusted; and (3) of being moved up or down for the purpose of adjusting the rollers in vertical direction. Not­withstanding the great latitude of movement thus provided each roller is furnished with a “ box-wheel,” which serves the double purpose of connecting or gearing it to the driving wheel, and of affording a fine adjustment. Each roller is further furnished with its own colour-box and doctors.

With all these delicate equipments at his command a machine printer is enabled to fit all the various parts of the most com­plicated patterns with an ease, despatch and precision which arc remarkable considering the complexity and size of the machine.

In recent years many improvements have been made in printing machines and many additions made to their already wonderful capacities. Chief amongst these are those embodied in the “ Inter­mittent ” and the “ Duplex” machines. In the former any or all of the rollers may be moved out of contact with the cylinder at will, and at certain intervals. Such machines are used in the printing of shawls and “ sarries ” for the Indian market. Such goods require a wide border right across their width at varying distances—sometimes every three yards, sometimes every nine yards—and it is to effect this, with rollers of ordinary dimensions, that “ intermittent ” machines are used. The body of the “ sarrie ” will be printed, say for six yards with eight rollers; these then drop away from the cloth and others, which have up to then been out of action, immediately fall into contact and print a border or “ crossbar,” say one yard wide, across the piece; they then recede from the cloth and the first eight again return and print another six yards, and so on continually.

The “ Duplex ” or “ Reversible" machine derives its name from the fact that it prints both sides of the cloth. It consists really of two ordinary machines so combined that when the cloth passes, fully printed on one side from the first, its plain side is exposed to the rollers of the second, which print an exact duplicate of the first impression upon it in such a way that both printings coincide. A pin pushed through the face of the cloth ought to protrude through the corresponding part of the design printed on the back if the two patterns are in good “ fit.”

The advantages possessed by roller-printing over all other pro­cesses are mainly three: firstly, its high productivity—10,000 to 12,000 yds. being commonly printed in one day of ten hours by a single-colour machine; secondly, by its capacity of being applied to the reproduction of every style of design, ranging from the fine delicate lines of copperplate engraving and the small “ repeats ” and limited colours of the “ perrotine ” to the broadest effects of block-printing and to patterns varying in “ repeat" from 1 to 80 in.; and thirdly, the wonderful exactitude with which each portion of an elaborate multicolour pattern can be fitted into its proper place, and the entire absence of faulty joints at its points of “ repeat ” or repetition—a consideration of the utmost import­ance in fine delicate work, where such a blur would utterly destroy the effect.

(5) *Stencilling.—*The art of stencilling is very old. It has been applied to the decoration of textile fabrics from time immemorial by the. Japanese, and, of late years, has found increasing employ­ment in Europe for certain classes of decorative work on woven goods for furnishing purposes.

The pattern is cut out of a sheet of stout paper or thin metal with a sharp-pointed knife, the uncut portions representing the part that is to be “ reserved ” or left uncoloured. The sheet is now laid on the material to be decorated and colour is brushed through its interstices.

It is obvious that with suitable planning an "all over” pattern may be just as easily produced by this process as by hand or machine printing, and that moreover, if several plates are used, as many colours as plates may be introduced into it. The peculiarity of stencilled patterns is that they have to be held together by “ties,” that is to say, certain parts of them have to be left uncut, so as to connect them with each other, and prevent them from falling apart in separate pieces. For instance, a complete circle cannot be cut without its centre dropping out, and, consequently, its outline has to be interrupted at convenient points by “ ties ” or uncut portions. Similarly with other objects. The necessity for " ties ” exercises great influence on the design, and in the hands of a designer of indifferent ability they may be very unsightly. On the other hand, a capable man utilizes them to supply the drawing, and when thus treated they form an integral part of the pattern and enhance its artistic value whilst complying with the condi­tions and the process.

For single-colour work a stencilling machine was patented in 1894 by S. H. Sharp. It consists of an endless stencil plate of thin sheet steel which passes continuously over a revolving cast iron cylinder. Between the two the cloth to be ornamented passes and the colour is forced on to it, through the holes in the stencil, by mechanical means.

(6) *Other Methods of Printing.—*Although most work is executed throughout by one or other of the five distinct processes mentioned above, combinations of them are not infrequently employed. Some­times a pattern is printed partly by machine and partly by block; and sometimes a cylindrical block is used along with engraved copper-rollers in the ordinary printing machine. The block in this latter case is in all respects, except that of shape, identical with a flat wood or “ coppered ” block, but, instead of being dipped in colour, it receives its supply from an endless blanket, one part of which works in contact with colour-furnishing rollers and the other part with the cylindrical block. This block is known as a “ surface ” or “ peg" roller. Many attempts have been made to print multicolour patterns with “ surface ” rollers alone, but hitherto with little success, owing to their irregularity in action and to the difficulty of preventing them from warping. These defects are not present in the printing of linoleum in which opaque oil colours are used—colours which neither sink into the body of the hard linoleum nor tend to warp the roller.

The printing of yarns and warps is extensively practised. It is usually carried on by a simple sort of “ surface ” printing machine and calls for no special mention.

Lithographic printing, too, has been applied to textile fabrics with somewhat qualified success. Its irregularity and the diffi­culty of printing “ all over ” patterns to “ repeat" properly, have restricted its use to the production of decorative panels, equal in size to that of the plate or stone, and complete in themselves.

Engraving of Copper Rollers

The engraving of copper rollers is one of the most important branches of textile-printing and on its perfection of execution depends, in great measure, the ultimate success of the designs. Roughly speaking, the operation of engraving is performed by three different methods, viz. (1) By hand with a graver which cuts the metal away; (2) by etching, in which the pattern is dissolved out in nitric acid; and (3) by machine, in which the pattern is simply indented.

(1) Engraving by hand is the oldest and most obvious method of engraving, but is the least used at the present time on account of its slowness. The design is transferred to the roller from an oil­colour tracing and then merely cut out with a steel graver, pris­matic in section, and sharpened to a bevelled point. It requires great steadiness of hand and eye, and although capable of yielding the finest results it is only now employed for very special work and for those patterns which are too large in scale to be engraved by mechanical means.

(2) In the etching process an enlarged image of the design is cast upon a zinc plate by means of an enlarging camera and prisms or reflectors. On this plate it is then painted in colours roughly approximating to those in the original, and the outlines of each colour are. carefully engraved in duplicate by hand. The necessity for this is that in subsequent operations the design has to be again reduced to its original size and, if the outlines on the zinc plate were too small at first, they would be impracticable either to etch or print. The reduction of the design and its transfer to a varnished copper roller are both effected at one and the same operation in the pantograph machine. This machine is capable of reducing a pattern on the zinc plate from one-half to one-tenth