of compartments are hollowed out, corresponding roughly in shape, size and position to the various objects cut on the block. The tops of the dividing walls of these compartments are then coated with melted pitch, and a piece of fine woollen cloth is stretched over the whole and pressed well down on the pitch so as to adhere firmly to the top of each wall ; finally a piece of string soaked in pitch is cemented over the woollen cloth along the lines of the dividing walls, and after boring a hole through the bottom of each compart­ment the sieve is ready for use. In operation each compartment is filled with its special colour through a pipe connecting it with a colour box situated at. the side of the sieve and a little above it, so as to exert just sufficient pressure on the colour to force it gently through the woollen cloth, but not enough to cause it to overflow its proper limits, formed by the pitch-soaked string boundary lines.

The block is then carefully pressed on the sieve, and, as the different parts of its pattern fall on different parts of the sieve, each takes up a certain colour which it transfers to the cloth in the usual way. By this method of "tobying ” from two to six colours may be printed at one operation, but it is obvious that it is only applic­able to patterns where the different coloured objects are placed at some little distance apart, and that, therefore, it is of but limited application.

Block-printing by hand is a slow process; it is, however, capable of yielding highly artistic results, some of which arc unobtainable by any other means, and it is, therefore, still largely practised for the highest class of work in certain styles.

(2) *Perrotine-Printing.—*The “ perrotine ” is a block-printing machine invented by Perrot of Rouen in 1834, and practically speaking is the only successful mechanical device ever introduced for this purpose. For some reason or other it has rarely been used in England, but its value was almost immediately recognized on the Continent, and although block-printing of all sorts has been replaced to such an enormous extent by roller-printing, the “ perro­tine ” is still largely employed in French, German and Italian works.

The construction of this ingenious machine is too complex to describe here without the aid of several detailed drawings, but its mode of action is roughly as follows:—Three large blocks (3 ft. long by 3 to 5 in. wide), with the pattern cut or cast on them in relief, are brought to bear successively on the three faces of a specially constructed printing table over which the cloth passes (together with its backing of printer’s blanket) after each impression. The faces of the table are arranged at right angles to each other, and the blocks work in slides similarly placed, so that their engraved faces are perfectly parallel to the tables. Each block is moreover provided with its own particular colour trough, distributing brush, and. woollen colour pad or sieve, and is supplied automatically with colour by these appliances during the whole time that the machine is in motion. The first effect of starting the machine is to cause the colour sieves, which have a reciprocating motion, to pass over, and receive a charge of colour from the rollers, fixed to revolve, in the colour troughs. They then return to their original position between the tables and the printing blocks, coming in contact on the way with the distributing brushes, which spread the colour evenly over their entire surfaces. At this point the blocks advance and are gently pressed twice against the colour pads (or sieves) which then retreat once more towards the colour troughs. During this last movement the cloth to be printed is drawn forward over the first table, and, immediately the colour pads are sufficiently out of the way, the block advances and, with some force, stamps the first impression on it. The second block is now put into gear and the foregoing operations are repeated for both blocks, the cloth advancing, after each impression, a distance exactly equal to the width of the. blocks. After the second block has made its impression the third comes into play in precisely the same way, so that as the cloth leaves the machines it is fully printed in three separate colours, each fitting into its proper place and completing the pattern. If necessary the forward movement of the cloth can be arrested without in any way inter­fering with the motion of the blocks—an arrangement which allows any insufficiently printed impression to be repeated in exactly the same place with a precision practically impossible in hand-printing.

For certain classes of work the "perrotine ” possesses great advantages over the hand-block; for not only is the rate of pro­duction greatly increased, but the joining up of the various impres­sions to each other is. much more exact—in fact., as a rule, no sign of a break in continuity of line can be noticed in well-executed work. On the other hand, however, the “ perrotine ” can only be applied to the production of patterns containing not more than three colours nor exceeding five inches in vertical repeat, whereas hand block-printing can cope with patterns of almost any scale and containing any number of colours. All things considered, therefore, the two. processes cannot be compared on the same basis : the “ perrotine" is best for work of a utilitarian character and the hand-block for decorative work in which the design only repeats every 15 to 20 in. and contains colours varying in number from one to a dozen.

(3) *Engraved Copperplate-Printing.—*The . printing of . textiles from engraved copperplates was first practised by Bell in 1770. It is now entirely obsolete, as an industry in England, and is only mentioned here because it is, to a slight extent, still used in Switzer­land for printing finely engraved borders on a special style of handkerchief the centre of which is afterwards filled in by block­printing.

The presses first used were of the ordinary letterpress type, the engraved plate being fixed in the place of the type. In later improvements the well-known cylinder press was employed; the plate was inked mechanically and cleaned off by passing under a sharp blade of steel; and the cloth, instead of being laid on the plate, was passed round the pressure cylinder. The plate was raised into frictional contact with the cylinder and in passing under it transferred its ink to the cloth.

The great difficulty in plate-printing was to make the various impressions join up exactly; and, as this could never be done with any certainty, the process was eventually confined to patterns complete in one repeat, such as handkerchiefs, or those made up of widely separated objects in which no repeat is visible, like, for instance, patterns composed of little sprays, spots, &c.

(4) *Roller-Printing, Cylinder-Printing, or Machine-Printing.—* This elegant and efficient process was patented and worked by Bell in 1785 only fifteen years after his application of the engraved plate to textiles. It will probably remain a moot question as to whether he was the originator of the idea, but it is beyond doubt that he was the first man to put into practice the continuous printing of cloth from engraved copper rollers. Bell's first patent was for a machine to print six colours at once, but, owing probably to its incomplete development, this was not immediately successful, although the principle of the method was shown to be practical by the printing of one colour with perfectly satisfactory results. The difficulty was to keep the six rollers, each carrying a portion of the pattern, in perfect register with each other. This defect was soon overcome by Adam Parkinson of Manchester, and in 1785, the year of its invention, Bell’s machine with Parkinson’s improvement was successfully employed by Messrs Livesey, Har­greaves, Hall & Co., of .Bamber Bridge,. Preston, for the printing of calico in from two to six colours at a single operation.

What Parkinson’s contribution to the development of the modem roller-printing machine really was is not known with certainty, but it was possibly the invention of the delicate adjustment known as “the box. wheel,” whereby the rollers can be turned, whilst the machine is in motion, either in or against the direction of their rotation.

In its simplest form the roller-printing machine consists of a strong cast iron cylinder mounted in adjustable bearings capable of sliding up and down slots in the sides of the rigid iron framework. Beneath this cylinder the engraved copper roller rests in stationary bearings and is supplied with colour from a wooden roller which revolves in a colour-box below it. The copper roller is mounted on a stout steel axle, at one end of which a cog-wheel is fixed to gear with the driving wheel of the machine, and at the other end a smaller cog-wheel to drive the colour-furnishing roller. The cast iron pressure cylinder is wrapped with several thicknesses of a special material made of wool and cotton—lapping—the object of which is to provide the elasticity necessary to enable it to properly force the cloth to be printed into the lines of engraving. A further and most important appliance is the “ doctor ”—a thin sharp blade of steel which rests on the engraved roller and serves to scrape off every vestige of superfluous colour from its surface, leaving only that which rests in the engraving. On the perfect action of this “ doctor ” depends the entire success of printing, and. as its sharpness and angle of inclination to the copper roller varies with the styles of work in hand it requires an expert to “ get. it up ” (sharpen it) properly and considerable practical experience to know exactly what qualities it should possess in any given case. In order to prevent it (the .“ doctor ”) from wear­ing irregularly it is given a to-and-fro motion so that it is constantly changing its position and is never in contact with one part of the engraving for more than a moment at a time. A second “doctor” of brass or a similar alloy is frequently added on the opposite side of the roller to that occupied by the steel or “ clean­ing ” doctor; it is known technically as the “ lint doctor ” from its purpose of cleaning off loose filaments or “ lint ” which the roller picks off the cloth during the printing operation. The steel or “ cleaning doctor ” is pressed against the roller by means of weighted levers, but the “ lint doctor ” is usually just allowed to rest upon it by its own weight as its function is merely to intercept the nap which becomes detached from the cloth and would, if not. cleaned from the roller, mix with the colour and give rise to defective work.

The working of the machine will be best understood by referring to the accompanying diagrammatic sketch of a single colour (fig. 1).