

Sept. 25, 1962

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3,055,296

PRINTING PROCESS AND APPARATUS

Filed Nov. 23, 1959

2 Sheets-Sheet 1

FIG. 1.

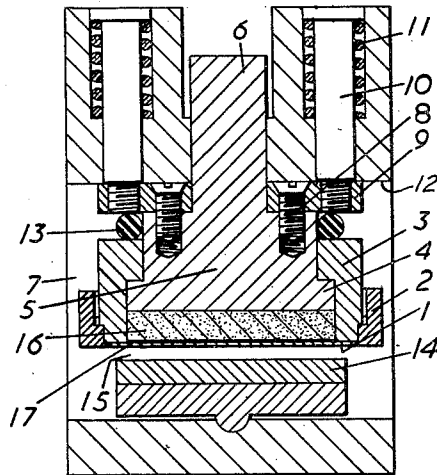
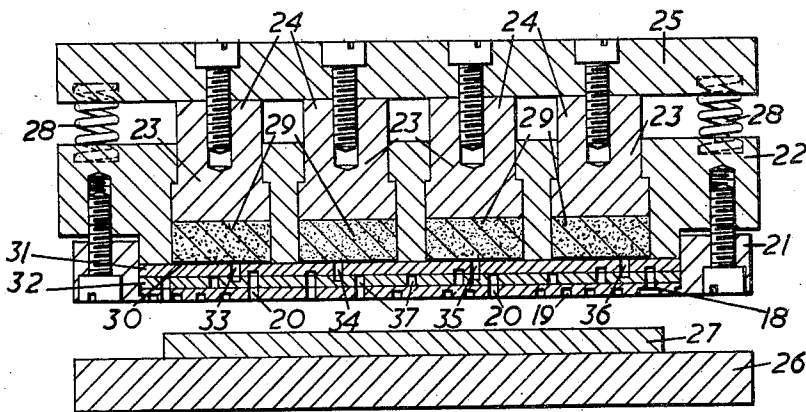


FIG. 2.



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2 Sheets-Sheet 2

FIG. 3.

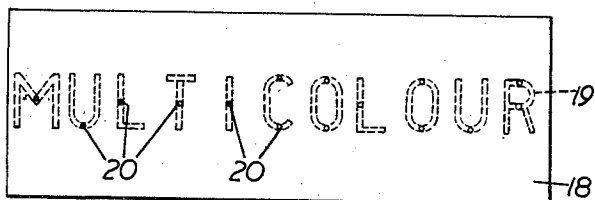


FIG. 4.

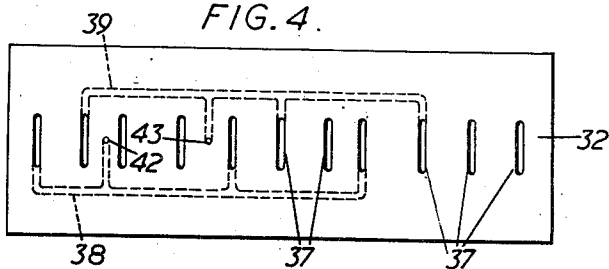
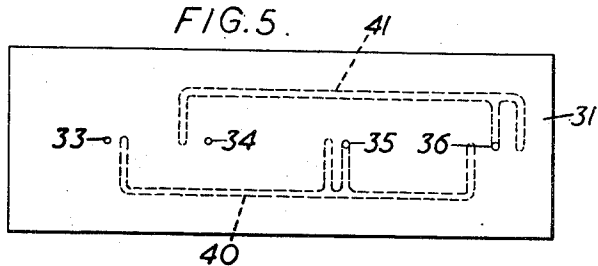


FIG. 5.



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1

3,055,296

PRINTING PROCESS AND APPARATUS
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Filed Nov. 23, 1959, Ser. No. 854,722

1 Claim. (Cl. 101—151)

This invention relates to printing processes and apparatus, and comprises improvements in the method of feeding ink to the printing surfaces of engraved printing plates or "dies".

The method of inking such dies at present used involves first spreading the ink over the engraved surface of the die so as to fill the indentations therein. The die is then wiped clean, leaving the indentations filled, and the die is subjected to heavy pressure in printing. Alternatively, the surface of the die may be covered with ink or pigment, leaving the indentations clean, so that an uninked embossing is produced on an inked background. These methods are expensive and thus somewhat limited in use.

According to the present invention an engraved printing plate is provided with ink passages extending through the thickness of the plate and communicating with the engraving so that ink can be forced through the printing plate and into the engraving by hydraulic pressure.

The method of inking the printing plate according to the invention consists in first bringing the engraved surface of the printing plate into contact with the surface on which the engraved design is to be printed and then forcing ink into the engraving under hydraulic pressure. The apparatus for carrying out this method may comprise a mounting containing an ink space closed on one side by the printing plate and means for applying pressure to the contents of the ink space in such a manner as to force the ink to pass through the passages in the printing plate and into the engraving thereof. The pressure-applying means may be a piston or pressure plate which may act directly on the ink space above referred to. The movement of the piston or pressure plate is preferably controlled by a spring or springs through which an initial pressure is applied before the displacement of ink by the movement of the piston or pressure plate commences. The initial pressure is arranged to be sufficient to confine the ink strictly to the cavities in the engraved surface of the die so as to print a clear and sharp image.

For use in colour printing, a number of separate reservoirs for inks of different colours may be arranged to communicate with portions of the engraving allocated to different colours so as to enable a two-colour or multi-colour image to be printed or stamped in one operation.

The invention will be fully understood from the following more detailed description with reference to the accompanying drawing in which:

FIGURE 1 is a sectional view of a cylindrical die and die-mounting suitable for use in a hand press,

FIGURE 2 is a similar view of a larger die and die mounting adapted for multi-colour printing,

FIGURE 3 is a plan showing a printing plate or "die" as it would appear if viewed from above in FIGURE 2, and

FIGURES 4 and 5 are similar plan views of two distributor plates.

In FIGURE 1, the reference numeral 1 indicates a printing-plate or "die" consisting of a steel plate having a thickness of say $\frac{3}{32}$ inch and having on its front face an engraving capable of being transferred to paper or other material by an intaglio printing process. The die 1 has numerous holes cut or drilled through its rear face and communicating with the engraving. These holes are designed to provide ink passages through which ink can

2

pass through the thickness of the die into every part of the engraving.

The die 1 is attached by means of a clamping ring 2 to the lower end of a hollow cylinder 3 containing a piston 4 forming part of a plunger 5 which projects through the upper end of the cylinder and terminates in an upwardly projecting stem 6.

The stem 6 of the plunger 5 is mounted free to slide up and down in a guide hole provided for it in a mounting block 7. In addition, the plunger 5 is attached by screws 8 to a plate 9 which is itself attached to a number of rods 10 mounted to slide in guide holes in the block 7 which are parallel to the guide hole in which the stem 6 slides. The rods 10 are controlled by springs 11 which constantly tend to raise the plunger 5 to a fully retracted position in which the ring 9 abuts against a face 12 of the mounting block 7. A resilient ring 13 made of rubber or like material is trapped between the ring 9 and the upper end of the cylinder 3 so that it constantly tends to maintain the piston 4 in a fully retracted position in the cylinder 3. A counterpart or a plain supporting plate 14 for the work to be stamped or printed upon is supported in the mounting block 7 immediately beneath the die 1, a sufficient clearance space 15 being left between the plate 14 and the die 1 for the insertion of the paper or other sheet to be printed upon. If the supporting plate 14 is plain it should be made of rubber or like material having sufficient resiliency to force a paper or like sheet into close engagement with the engraving.

The space left in the cylinder 3 between the piston 4 and the die 1 constitutes an ink reservoir which normally contains an absorbent pad 16 made of felt or other suitable compressible material capable of absorbing printing ink. A sheet of filter paper 17, or a very closely woven nylon or other fabric of paper-like appearance is preferably inserted between the pad 16, plunger 5 and the die 1 for a purpose which is explained below.

In the use of the die and die-mounting shown in FIGURE 1, the pad 16 is charged with a printing ink such as is used for die stamping and the die mounting is placed in a press capable of exerting downward pressure on the stem 6. The paper sheet or other material to be printed upon is inserted between the die 1 and the supporting plate 14. As the plunger 5 is pressed downwards by the action of the press, the cylinder 3 at first moves with it so that the die 1 is brought into contact with the surface to be printed upon and is initially pressed firmly against that surface with a thrust transmitted through the ring 13. As the pressure increases, the ring 13 yields and allows the piston 4 to move downwards in the cylinder 3. The pad 13 is thus compressed so that a quantity of ink is squeezed out of the pad and is forced through the thickness of the die 1 and into the engraving on the front face thereof.

To obtain a clear and sharp image, the resilient ring 13 should be arranged to force the die into close engagement with the surface to be printed upon so as to seal the cavities of the engraving against the escape of ink before any ink is forced into the cavities. This may be ensured by providing a clearance of say ten thousandths of an inch between the pad 16 and the die 1 in the fully retracted position of the piston 4.

When the press head is retracted, the resilient ring 13 will maintain the die in contact with the printed surface until the piston 4 has been retracted. The piston thus has a tendency to suck back excess ink at the end of each stamping operation. However, it is sometimes found necessary to provide some other means for preventing the escape of excess ink from the die. The filter paper or closely woven fabric 17 serves this purpose by acting as an obstruction capable of preventing any flow

3

of printing ink except under hydraulic pressure developed by the action of the piston 4.

FIGURE 2 shows a modified construction in which a die 18 is engraved with four different colour images all engraved upon the front surface of the die. For purposes of illustration, the engraving on the die 21 is shown in FIGURE 3 as consisting of the eleven-letter word "Multi-colour," and it is assumed that the four colours are to be allocated to different letters in such a way that the first colour image is made up of the first, fifth and eighth letters of the word, the second colour image is made up of the second, sixth and ninth letters, the third colour is made up of the third, seventh and tenth letters and the fourth colour is made up of the fourth and eleventh letters. The engraving (marked 19 in FIGURES 2 and 3) communicates with a sufficient number of holes 20 cut or drilled through the rear face of the die to enable printing ink to be forced through the thickness of the die and into every part of the engraving that is to receive ink. For convenience of illustration a simple engraving requiring relatively few holes 20 has been shown, but a far greater number of holes 20 may be required for more complicated or more extensive engravings. The die is secured by means of a clamping frame 21 to a body 22 containing four pistons 23 working in four separate chambers designed to act as reservoirs for the four different colours to be used. The pistons 23 have stems 24 attached to a common upper pressure plate 25 adapted to be attached to the upper pressure member of a press in some convenient manner. A cooperating lower pressure plate 26 carries a supporting plate 27 for the work to be printed upon. The pistons 23 are normally held in their fully retracted positions by the action of springs 28 compressed between the plate 25 and the body 26. The springs 28 are pre-loaded sufficiently to press the die into engagement with the surface to be printed upon with sufficient force to prevent the escape of ink from the cavities of the engraving.

Each of the chambers in the body 22 contains an absorbent pad 29 similar to the pad 16 described with reference to FIGURE 1. Each chamber may also contain a sheet of filter paper or closely woven fabric 30 corresponding to the sheet 17 described with reference to FIGURE 1.

In order to distribute the different colours to the appropriate parts of the die 1, two distributor plates 31 and 32 are interposed between the body 22 and the die 18. The plate 31 has four ports 33, 34, 35 and 36, which allow the colours to escape from the chambers in the body 22 only at those points in the area of the distributor plate 31 where the ports 33, 34, 35 and 36 are located. The plate 32 has a sufficient number of holes 37 cut or drilled through its thickness to distribute ink to the whole of the engraving 19. In the drawing, the holes 37 are elongated holes arranged parallel to one another at intervals corresponding to the spacing of the letters forming the engraving 19, but other arrangements may be used to suit different engravings. The holes 37 must be so spaced as to supply ink to the rear surface of the die 18 at as many different points as are necessary to communicate through the holes 20 with the whole of the engraving 19.

The colours from the ports 33 and 34 are distributed to the appropriate holes 37 by grooves 38 and 39 respectively cut in the lower surface of the plate 32. Each groove 38 and 39 is cut in a suitable pattern which relates to one colour only and which is designed to deliver ink from the port 33 or 34 which delivers that colour to all the holes 37 to which the colour is to be distributed. The colours from the ports 35 and 36 are distributed to the remaining holes 37 by grooves 40 and 41 which are cut in the lower surface of the plate 31 so as not to intersect the grooves 38 and 39. The colours are delivered to the grooves 38 and 39 from the ports 33 and 34 through registering ports 42 and 43 cut in the plate 32. It will be evident that the contiguous surfaces of the

4

printing plate 18 and distributor plates 31 and 32 must be in very close contact in order to seal the ink passages formed by the grooves 38, 39, 40 and 41. A sealing compound resistant to the inks used may be introduced between the plates 31 and 32 and between the plate 32 and the printing plate 18 to seal the joints between these various plates.

In the use of the die and die mounting shown in FIGURE 2, the pads 29 are charged with different coloured inks, and the die mounting is placed in a suitable press. The paper sheet or other material to be printed upon is inserted between the die 18 and the supporting plate 27.

As the plate 25 is pressed downwards by the action of the press, the body 22 at first moves with it so that the die 18 is brought into contact with the surface to be printed upon and is initially pressed firmly against that surface with a thrust transmitted through the springs 28. As the pressure increases, the springs 28 yield and allow the pistons 23 to move downwards in the body 22. The pads 29 are thus compressed so that a quantity of ink is squeezed out of each pad. The inks thus forced through the ports 33, 34, 35 and 36 are delivered through the channels formed by the grooves 38, 39, 40 and 41 respectively to the various holes 37 to which the different colours are to be supplied, and from these holes the inks pass through the thickness of the die and into the engraving at every point required. A small clearance may be left between the pads 29 and the plate 31 in the fully retracted position of the pistons 23 to ensure that the die is forced into close engagement with the surface to be printed upon so as to seal the cavities of the engraving against the escape of ink before any ink can be forced into the cavities.

It will be observed that the grooves 38 and 39 in the plate 32 form ducts which are at a different level from the ducts formed by the grooves 40 and 41 in the plate 31 so that the ducts 38 and 39 can pass across the ducts 40 and 41 at one or more points without interfering with one another. This principle can be extended by increasing the number of distributing plates so as to provide distributing ducts at different levels for as many different colours as may be required, each duct being in communication with at least one passage leading upwards to a supply port or ports for ink of one colour and being in communication with as many passages leading downwards as may be necessary to supply all those parts of the engraving 19 that have to be fed with ink of that colour.

Although the construction shown in FIGURES 1 and 2 of the drawings both have ink-supply chambers contained entirely within the die mounting, it is possible to supply the ink to the die mounting from an external reservoir or reservoirs connected to the die mounting by flexible pipes. When this is done the die mounting need contain no pistons. Instead, the ink may be forced through the flexible pipe or pipes and into a suitable chamber or chambers behind the die by a pump or pumps which may be arranged to be operated independently of the action of the press by a mechanism arranged to be brought into operation after the press has been closed. Another device which may be used for forcing the ink through the die is a pressure roller arranged to be rolled across a pad similar to the pad shown at 16 in FIGURE 1. The pressure roller squeezes the ink out of different parts of the pad progressively as the pressure roller moves across the machine and thus forces the ink into the engraving from different parts of the pad in turn. If it is required to feed different colours to different parts of the engraving, the ink space behind the die may be divided into corresponding parts by suitable partitions and covered by a rubber or like flexible sheet through which the pressure of the roller is transmitted to each part of the ink space as the pressure roller moves across the machine.

The openings by which the ink passes through the thickness of the printing plate need not necessarily be cut or drilled through the plate. Instead, the plate may be

5

made from sintered metal or other porous material coated on one face by electroplating or otherwise so as to have a thin impervious skin in which the design can be engraved or etched in such a way that the engraving penetrates completely through the skin. To enable this porous plate construction to be used for printing designs in more than one colour, the die could be divided into sections separated by sealing walls arranged to make close contact with the plate 32 so as to prevent mixing of the colours.

It will be obvious that the construction shown in FIGURE 2 could be adapted for printing in two colours by providing it with only two pistons and cylinders or it could be adapted to print in three colours or in more than four colours.

The pistons 4 or 23 could be replaced by diaphragms or some other form of pressure plates capable of forcing the ink through the printing plate.

The term "ink" when used herein is not limited to ordinary printing ink but includes substances or compositions which can be used as substitutes for ink.

I claim:

Printing apparatus comprising a body containing a plurality of supply chambers for inks of different colours; an engraved printing plate attached to said body and having an intaglio engraving divided into a plurality of separate portions allocated to different colours, said printing plate being provided with a plurality of ink passages extending through the thickness thereof and each com-

6

municating with one of said engraving portions; a plurality of distributor plates interposed between said printing plate and said chambers, said printing plate and distributor plates having contiguous surfaces in close contact with one another, and said distributor plates having a plurality of grooves forming distributing ducts arranged at different levels within the combined thickness of the plates, each duct being in communication with at least one passage leading in one direction through the thickness of said distributor plates to one of said supply chambers and with as many passages leading in the opposite direction through the thickness of said distributor plates to at least one of said engraving portions as are necessary to supply said engraving portion; and means for bringing said printing plate into contact with a surface to be printed on and then forcing ink from said chambers through said ducts and into said engraving portions under hydraulic pressure.

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