Feb. 27, 1951 A. MURRAY 2,543,047

METHOD OF PRINTING THROUGH CELLULAR PLATES

Filed May 21, 1947 2 Sheets-Sheet 1

FIG. 1.

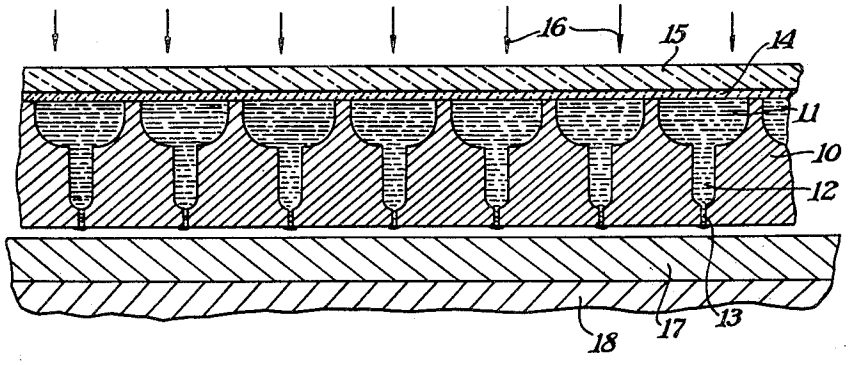


FIG. 5.

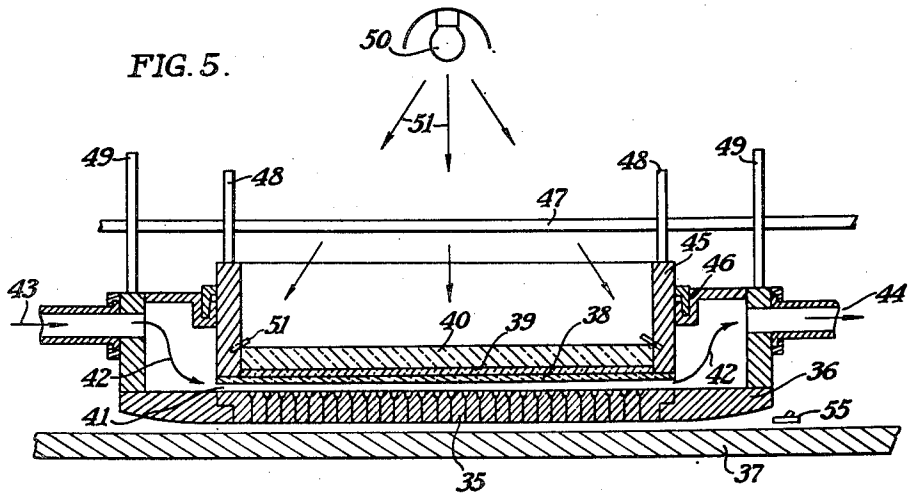


FIG. 2.

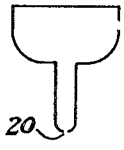
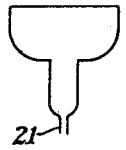


FIG. 3.



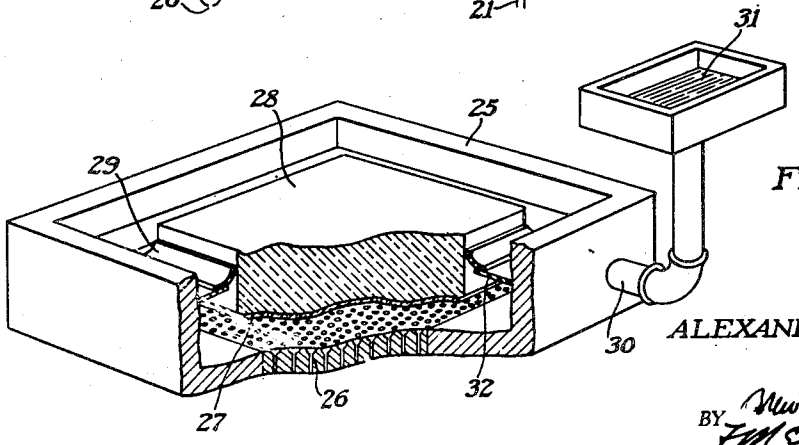


FIG. 4.

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FIG. 6.

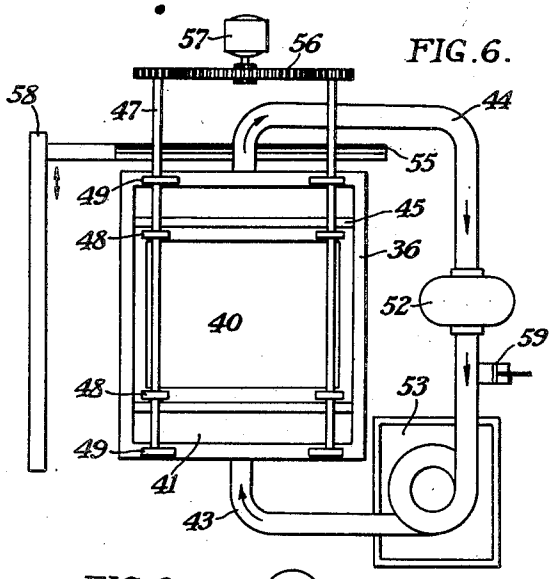


FIG. 7.

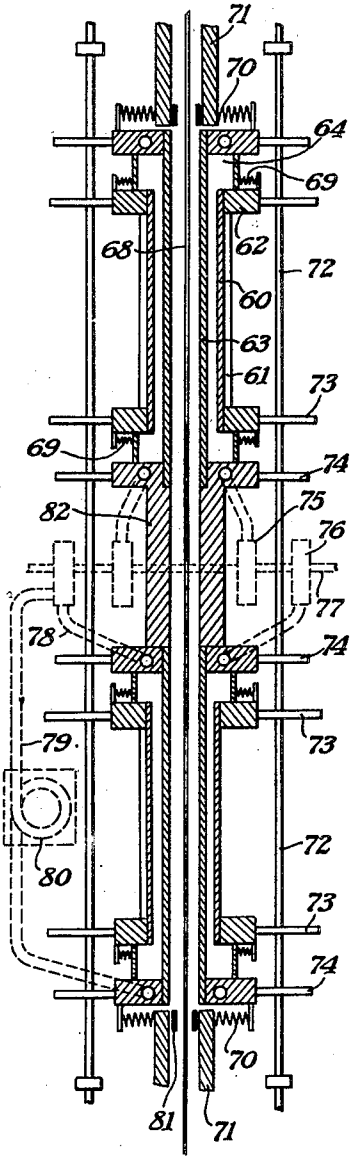
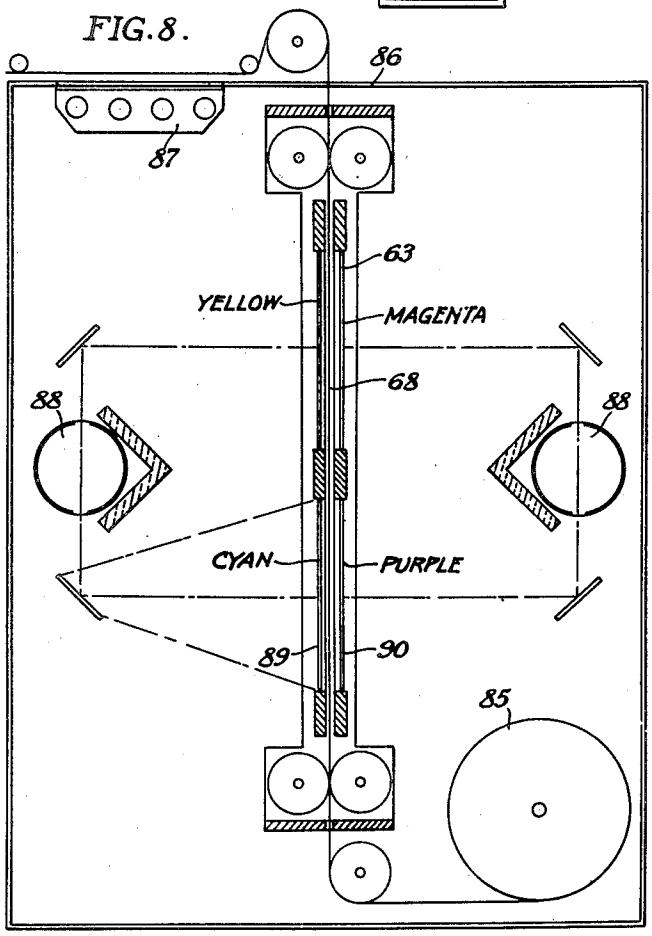


FIG. 8.



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Patented Feb. 27, 1951 2,543,047

UNITED STATES PATENT OFFICE

2,543,047

METHOD OF PRINTING THROUGH CELLULAR PLATES

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Application May 21, 1947, Serial No. 749,447

3 Claims. (Cl. 101—426)

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This invention relates to a method of printing and particularly to an improved manner of using a cellular printing plate or so-called Glassey Block as described by C. Q. Glassey, in his patent application Serial Number 745,019, filed April 30, 1947.

The object of the present invention is to provide greater speed of operation and greater simplicity in the use of the Glassey Block, particularly the form of block which is inked from the rear.

The most important feature of the present invention is the fact that the printing fluid itself is used as the temperature control medium. In the Glassey printing system the plate is heated differentially in accordance with a radiant energy image during each printing cycle and preferably should be returned to a standard initial temperature at the start of each cycle. According to the present invention, this is accomplished by controlling the temperature of the ink supply and by flowing a quantity of ink across the plate during the inking operation. Of course, the ink transferred from the front surface of the printing plate to the paper carries some of the heat with it so that at the end of the printing cycle the temperature of the plate is not as high as it would otherwise be. However, it is still somewhat above the initial temperature and therefore must be cooled.

The proper initial temperature and the range of temperature through which the plate or parts thereof may move depends on the particular printing fluid used and on the size of the cells. In general it appears better to have the initial temperature considerably above ordinary room temperature and for the sake of rapidity of operation, to have the maximum increment of temperature required to print as small as will conveniently deposit the required amount of ink.

The circulating ink should preferably be at an average pressure somewhat below atmospheric pressure so that there is a tendency to push ink from the front surface of the plate toward the rear, which tendency is overcome by the capillary action or surface tension at the narrow front openings of the cells in the Glassey block. This low pressure inking is applicable to all rear inking embodiments of the Glassey printing system.

The operation of the invention will be fully understood from the following description when read in connection with the accompanying drawings, in which:

Fig. 1 is a greatly enlarged cross section of one form of cellular printing plate at the start of a printing cycle.

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Figs. 2 and 3 illustrate slightly different forms of cells useful in such plates.

Fig. 4 is a perspective view partly cut away of apparatus for one embodiment of the present invention.

Figs. 5 and 6 are respectively a vertical section and a top view of a printing press incorporating another embodiment of the invention.

Fig. 7 is a vertical section of the essential parts of a four color printing press according to the invention.

Fig. 8 similarly illustrates auxiliary parts of the printing press shown in Fig. 7.

In Fig. 1 a cellular plate 10 of metal or plastic or any other suitable material comprises a plurality of cells 11 more or less uniformly distributed over the area of the plate. There should be at least 1000 cells per square inch for 33 line quality and there should be 40,000 cells per square inch for 200 line quality. The cells have a narrow opening 13 through the front of the printing plate and preferably have a section 12 of reduced diameter joining this capillary opening 13 to the main part of the cell 11. Each of the cells is wide open to the rear of the plate. In fact over the rear surface, there is in general more cell area than wall structure, but this is not a critical feature of the invention.

In printing with such a plate, the cells are filled with ink, in a manner to be described in detail below, and then the rear opening of the cell is closed off by a transparent plate 14 clamped tightly on the plate. A negative 15 of the image to be printed is held against the plate 14 and illuminated from the above with light indicated by arrows 16. Alternatively the radiant energy image may be projected by a suitable lens system onto the plate 14. In either case the radiant energy heats the ink in the cells 11 and expels it through the orifices 13, differentially in accordance with the density of the negative 15, to form an image on a sheet of paper 17, held in contact with the printing plate by a resilient layer 18.

For maximum speed of operation the ideal cell is shown in Fig. 2 in which the capillary orifice 20 whose diameter is .0004 inch say, is of very short length so as to impose the minimum of resistance to the flow of ink. However, a fairly and reasonably rapid operation can still be obtained with a slightly longer capillary 21 as shown in Fig. 3. For example the capillary may have a length of 10 times its diameter. In general it is easier to manufacture a plate with cells such as shown in Fig. 3 since the uniformity

in length of capillary is not as critical as it is with the preferred form shown in Fig. 2.

The present invention is concerned with the method of inking and particularly the method of cooling the cellular printing plate between prints. One method according to the invention is illustrated in Fig. 4 in which the printing plate 26 is set into and forms the major portion of the bottom of a relatively heavy metal box 25. The transparent cover sheet 27 for the cellular block is shown in the separated position. It is carried by a large glass block 28 and for contact printing, the negative is held between the plates 27 and 28. A rubber gasket 29 seals the join between the glass block 28 and a shelf 32 which together with the walls of the box 25 forms an ink chamber. Ink is supplied to this chamber and maintained at constant pressure therein by a pipe 30 and reservoir 31. The reservoir 31 is shown open to the atmosphere but may be a closed chamber with controlled pressure for embodiments of the invention in which this pressure is maintained below atmospheric.

After each printing operation the transparent layers 27 and 28 are raised from the printing block 26 allowing the ink in the surrounding chamber to flow in across the back of the printing block 26. This ink is at a relatively low temperature due to the metal box 25 which may be kept cool by suitable fan or water circulating system not shown. This cooled ink tends to bring the temperature of the printing plate 26 back to its initial temperature. Thus the printing plate 26 is inked and cooled at the same time merely by the raising of the layers 27 and 28 away from the printing plate 26.

In Fig. 5 the celludar printing plate 35 is carried in a supporting frame 36 and is shown between printing steps slightly above a layer 37 of paper to be printed. The rear layer 38 of the plate is also separated from the cells and as before a negative 39 is clamped between the layer 38 and a glass block 40 held by pegs 51 in place in a supporting frame 45. The frames 36 and 45 form a closed ink chamber sealed off by a seal 46 which allows the frame 45 to be raised from the frame 36 lifting the plate 38 from the back of the printing plate 35. This leaves a low chamber 41 immediately above the printing plate 35 across which cool ink is flowed as indicated by arrows 42. The ink is supplied through a pipe 43 and flows out through a pipe 44. The pumping mechanism 52, the cooling mechanism 53 and the means 59 for maintaining the desired pressure in the system are all shown in Fig. 6. The relatively cool ink brings the plate 35 to the proper starting temperature and then by means of cams 48 and 49 carried on a cam shaft 47, the frame 45 is first moved down to bring the plate 38 in contact with the printing plate 35 closing off the ink cells and then the whole printing system including frames 45 and 36 move down to bring the printing plate in contact with the paper 37.

It is sometimes desirable to work at slightly higher pressures in the ink circulating systems and these pressures occasionally allow ink to flow from the front surface of the printing plate before the printing operation starts, particularly as the plate 38 is moved into contact with the printing plate 35. In these embodiments, a doctor blade 55 is moved very rapidly across the front surface of the printing plate 35 by a driving mechanism 58 shown schematically, just before the printing plate 35 is moved into contact with the paper 37. It is preferable to have two sets of cams for raising and lowering the frames 36 and 45 against a spring action (the showing of which has been omitted for the sake of clarity). The two sets of cams are driven by a single drive chain 56 operated by any suitable mechanism such as a motor 57.

The arrangement shown in Figs. 7 and 8 illustrates one form of four color printing press incorporating an embodiment of the invention very similar to that shown in Figs. 5 and 6. This particular press prints two colors on each side of a transparent pellicle which is later laminated to an opaque white support such as paper, but the present invention is applicable directly to other four color printing systems merely by registering the successive color separations made with arrangements such as shown in Figs. 5 and 6. In Figs. 7 and 8 a transparent pellicle 68 from a stock roll 85 is moved between two pairs of printing plates 63 for simultaneously printing two colors on each side of the pellicle. The pellicle moves from the printing box 86 across an illuminator 87 for inspection. The whole printing press, including motors and driving mechanisms is housed in a cabinet forming about a 30 inch cube for printing prints up to 8 x 10 inches. For clarity in Fig. 8 only the printing plates 63 are shown, but of course each is accompanied by a transparent closure plate 60 and color separation negative 61 carried in a frame 62. In the position shown in Fig. 7, the rear plate 60 is held away from the printing plate 63 by springs 69 leaving an ink chamber 64 through which ink is flowed by a pumping mechanism 75. The pumps 75, 76, etc. for the four plates are all carried on a single drive shaft 77. The pumps are shown by broken lines so as not to confuse the drawing which primarily illustrates the printing plates. The ink moves through pipes 78 and 79 and a cooling chamber 80 as above described in connection with Figs. 5 and 6. After the plates have been inked, the turning of the cam shaft 72 turns the cam 73 so that the plates 60 clamp the printing plate 63 sealing off the ink cells. The cams 74 then start to move the plate supporting frame 82 and the cams 73 continue to move the frames 62 so that contact between the plates 60 and 63 is maintained. This clamps the pellicle 68 and then the light from lamps 88 illuminates the rear of each of the printing plates expelling ink to print on the pellicle as above described. The light is then cut off and the pellicle unclamped and moved to the next printing position in which the image printed by the cyan and purple printing plates 89 and 90 is moved into exact register with that to be printed by the yellow and magenta plates. When operating under conditions in which there is sufficient time and pressure on the ink to allow it to flow through the printing plate during the inking operation, doctor blades 81 are moved in front of the plates to the center of the printing system while the pellicle is moved forward and then just after the plate 60 is clamped to the plate 63 these doctor blades 81 wipe the printing plate surface very rapidly and move to the position shown in Fig. 7 where they remain during successive parts of the cycle. The operation of the cams 74 is against the force of springs 70 carried by the main frame 71 of the printing press.

Having thus described preferred embodiments of my invention, I wish to point out that it is

not limited to these particular structures but is of the scope of the appended claims.

I claim:

1. The method of printing though a cellular plate having cells uniformly distributed over the plate with a narrow opening of capillary dimensions from each cell through the front surface of the plate and a relatively large opening from each cell through the rear surface, by filling the cells with printing fluid through the relatively large rear openings, closing the rear openings with a transparent sheet and heating the fluid in the cells by illuminating the rear surface with a radiant energy image absorbable by the fluid, said image being negative to that to be printed, to expel printing fluid from the narrow front openings, differentially in accordance with the image, onto a surface to be printed characterized by the step of re-inking the plate before each printing operation by raising the transparent sheet from the rear surface and flowing onto the rear surface, the printing fluid at a constant temperature just slightly below that at which the plate should be at the start of the illuminating step, the slight difference being just that which brings the plate to the starting temperature from the higher temperature it reaches at the end of the illuminating step.

2. The method according to claim 1 in which the printing fluid is circulated through a temperature control chamber and across the rear surface of the printing plate at an average pressure below the atmospheric pressure at the front surface of the plate, but not sufficiently below to overcome the surface tension which tends to hold the printing fluid level with the narrow front openings in the plate.

3. The method of printing through a cellular plate having cells uniformly distributed over the plate with a narrow opening of capillary dimensions from each cell through the front surface of the plate and a relatively large opening from each cell through the rear surface, by filling the cells with printing fluid through the relatively large rear openings, closing the rear openings with a transparent sheet and heating the fluid in the cells by illuminating the rear surface with a radiant energy image absorbable by the fluid, said image being negative to that to be printed, to expel printing fluid from the narrow front openings, differentially in accordance with the image, onto a surface to be printed characterized by the step of re-inking the plate before each printing operation by raising the transparent sheet from the rear surface and flowing onto the rear surface, the printing fluid at an average pressure below the atmospheric pressure at the front surface of the plate, but not sufficiently below to overcome the surface tension which tends to hold the printing fluid level with the narrow front openings in the plate.

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No references cited.