

April 7, 1953

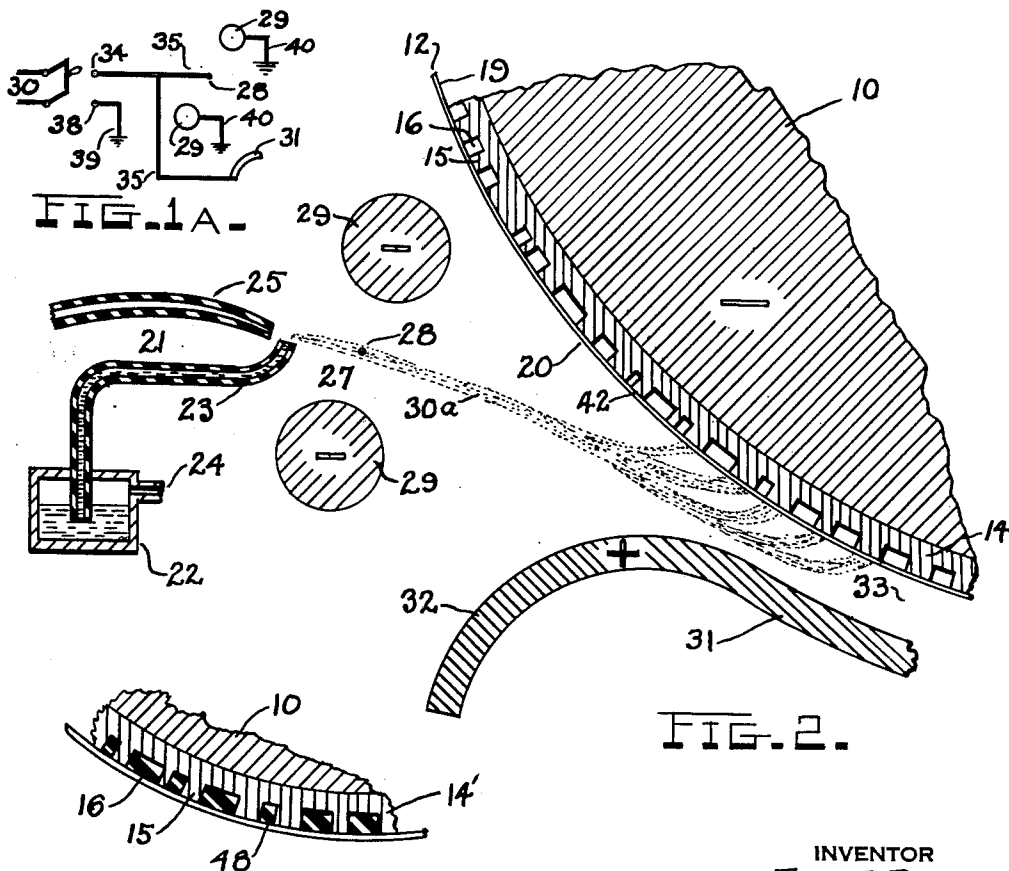
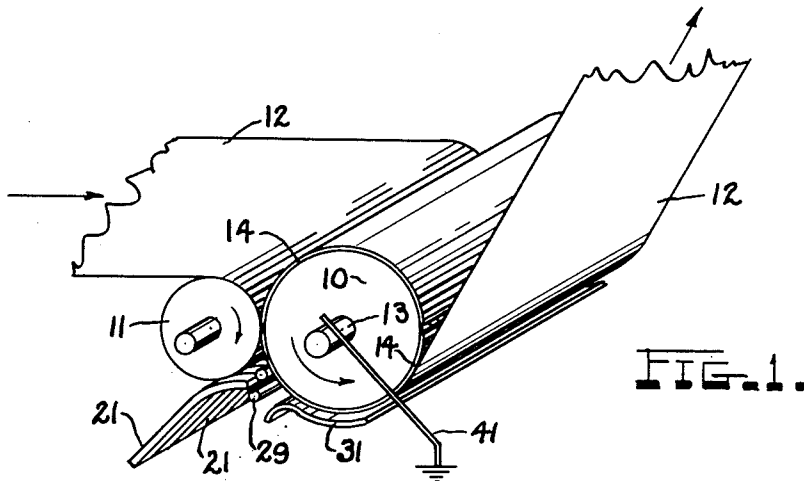
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2,633,796

PRINTING MEANS USING ELECTRIC FIELDS

Filed April 5, 1944

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

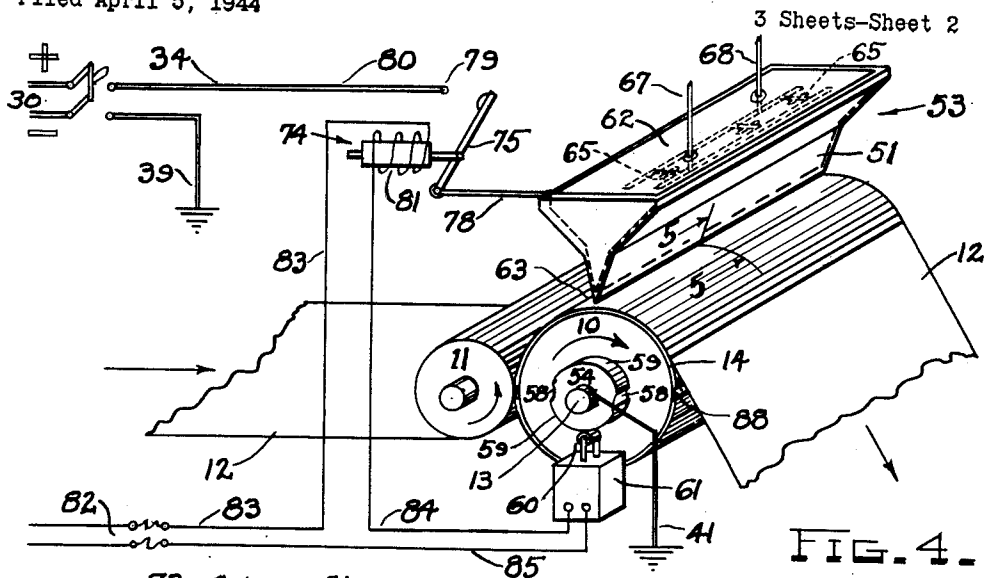


FIG. 4.

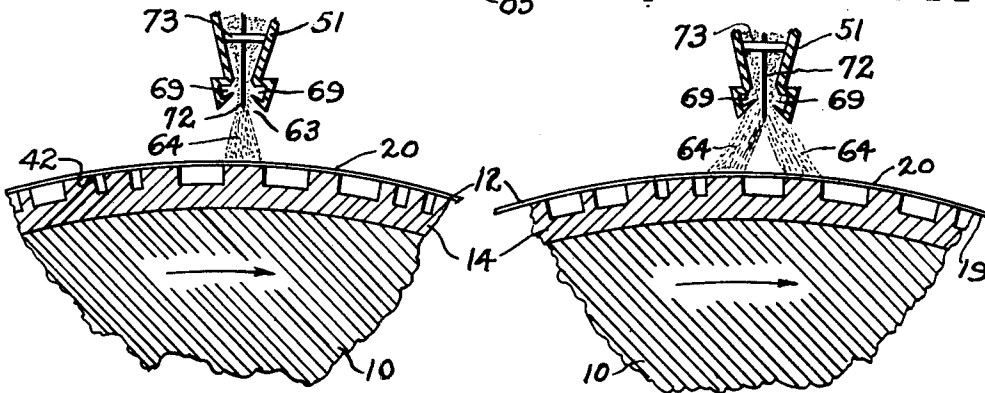


FIG. 5.

FIG. 6.

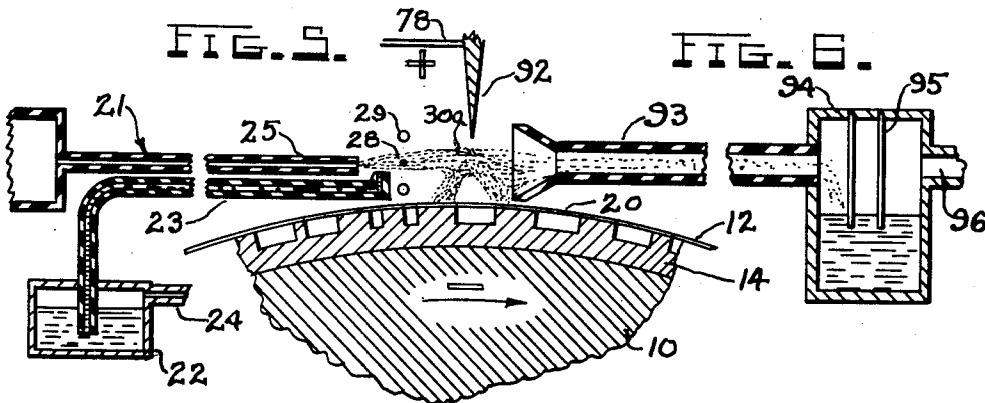


FIG. 7.

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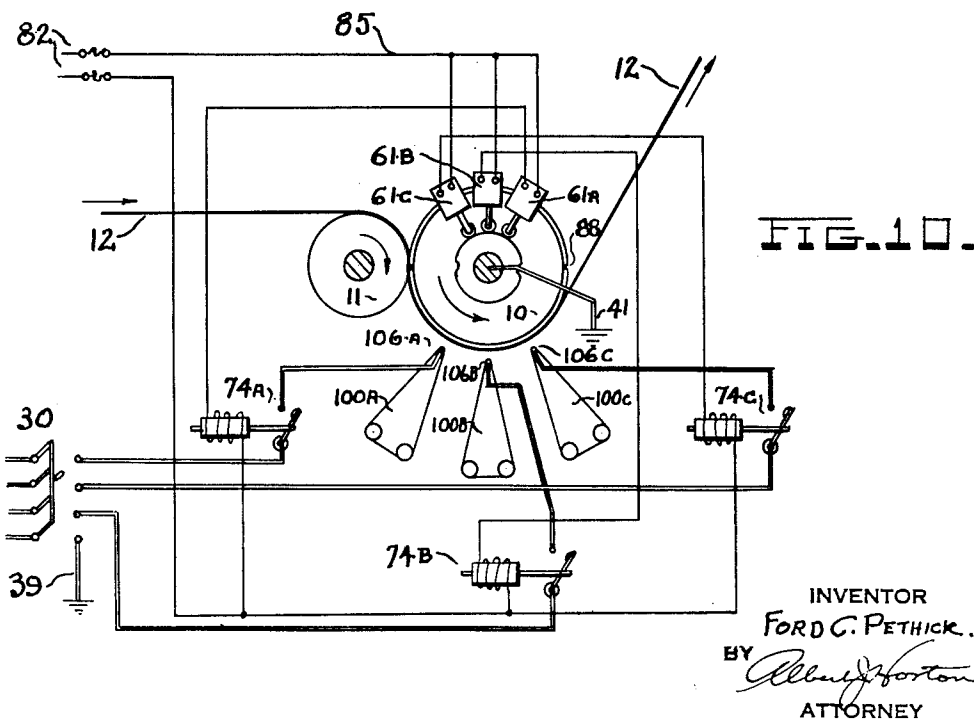
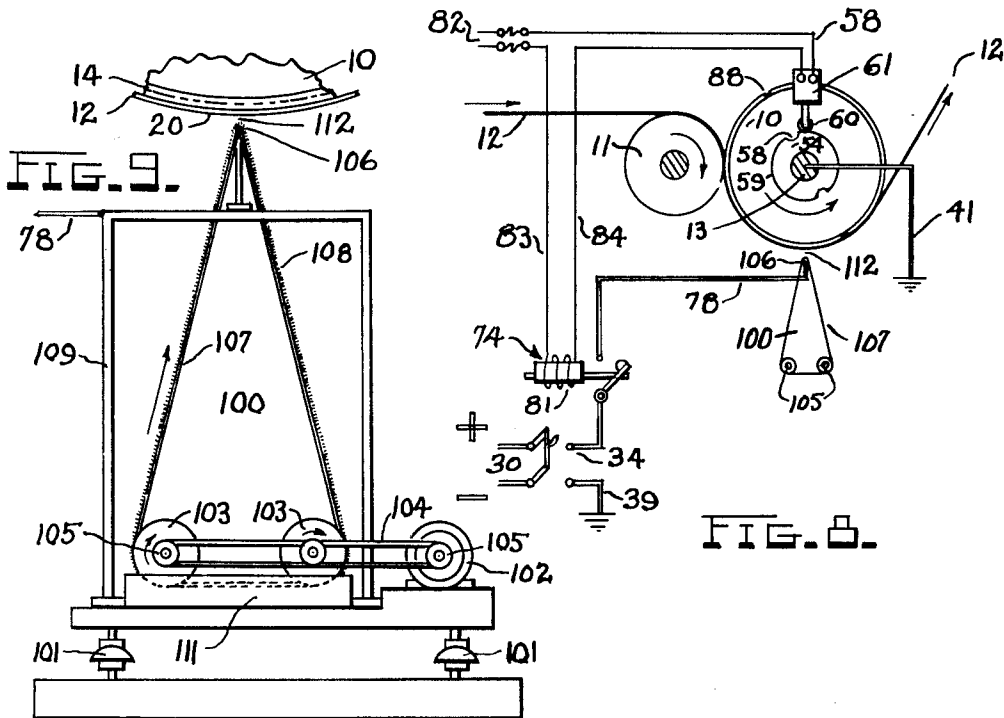
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,633,796

PRINTING MEANS USING ELECTRIC FIELDS

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3 Claims. (Cl. 101—212)

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This invention relates to a novel method and means for printing, and more specifically refers to depositing ink through the influence of an electric field.

The invention contemplates as its principal object, the provision of a method and means for printing which does away with the necessity of inking type before an object can be printed therefrom.

Another object of the invention is to provide a method and means for transferring ink directly from an ink supplying mechanism to the material to be printed.

Another object of the invention is to provide a new and improved mechanism from which ink can be transferred directly to the material to be printed.

Another object of the invention is to provide a means to limit the portion of the web or sheet on which ink may be deposited.

Still another object of the invention is to provide a new type of printing plate.

Other and further important objects of the invention will become apparent from the following description and the appended claims.

In accordance with the invention, as herein shown, a travelling web of paper is passed between a plate carrying form cylinder and an ink supplying mechanism. Due to forces set up by an electric field, ink is removed from the ink supplying mechanism and deposited on the web in accordance with a design carried by the form cylinder.

For a more complete understanding of the invention, reference should be had to the accompanying drawings in which:

Figure 1 is a perspective view of a portion of a printing machine embodying the principles of the invention;

Figure 1A is an electrical diagram showing a method of supplying electric power to the printing unit shown in Figure 1;

Figure 2 is an enlarged cross sectional view of a portion of the printing unit shown in Figure 1;

Figure 3 is a fragmentary view similar to a portion of Figure 2 and depicting a modified form of printing plate;

Figure 4 is a perspective view of portions of a printing machine showing a modified form of the invention;

Figure 5 is an enlarged cross sectional view taken through the line 5—5 of Figure 4, and looking in the direction of the arrows;

Figure 6 is a view similar to Figure 5, but showing the form cylinder in a slightly advanced position;

Figure 7 is a fragmentary cross sectional view showing another modified form of the invention;

Figure 8 is a view showing a printing machine equipped with a modified form of ink supplying mechanism;

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Figure 9 is an enlarged view of the ink supplying mechanism shown in Figures 8 and 10; and

Figure 10 is a view, showing a further development of the form of the invention depicted in Figure 8.

Referring to the drawings, the invention has been shown in one form in Figures 1, 1A and 2 as applied to a web printing machine comprising a form or type cylinder 10, which cooperates with a guide roller 11 about which a sheet or web 12 of paper or other suitable material is led. The form cylinder 10 is rotatable on a shaft 13 and carries a printing form or plate 14 having a design formed by raised, sharp-edged type 15 intermingled with depressions 16. The plate 14 may be constructed according to usual practices, except, that the letters, numerals, and other designs appearing on the surface thereof, should be direct reading in place of reversed as is the practice with present day newspaper and magazine plates.

As illustrated in Figure 1, the web 12 passes over the guide roller 11 and about the lower portion of the form cylinder 10. As illustrated, a surface 19 of the web 12 is in contact with the form or plate 14, while a surface 20 of the web is exposed.

A means for printing on the exposed side 20 of the web 12 has been provided adjacent to the exposed side thereof, and includes a plurality of atomizer type ink supplying mechanisms 21, each having an enclosed ink reservoir 22, and an insulated ink supply tube 23. Preferably ink is caused to rise in the tubes by means of air pressure supplied to the reservoir by way of an air duct 24. An air blast from insulated nozzles 25 cooperates with each insulated ink tube, to atomize the ink and to produce an ink mist. A means 27 for electrifying the ink spray or mist is positioned directly in front of the atomizer 21, and in the embodiment of the invention illustrated in Figures 1, 1A and 2, comprises a fine wire 28 positioned parallel to the axis of the cylinder 10 and located parallel to and between a pair of parallel cylindrical rods 29. A high voltage source of direct current 30 is connected between the wire 28 and rods 29, the wire 28 preferably being charged positively with respect to the rods 29 which may be maintained at ground potential.

As particles of ink in the ink mist pass the highly charged wire 28, they acquire a positive electrical charge and form a positively charged ink mist 30a. A shield 31, having a flared portion 32, is positioned concentric with the form cylinder 10 and preferably is spaced one-eighth to one-half an inch therefrom. The atomizer 21 and the electrifying mechanism 27 are positioned so that, the stream of electrified ink mist 30a is directed toward the space 33 between the exposed side 20 of the web 12, and the shield 31.

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The shield 31 is highly charged positively with respect to the form cylinder 10, which may be maintained at ground potential.

One method of electrifying various portions of the equipment is shown in Figure 1A wherein the wire 28, and shield 31 are shown connected to a positive terminal 34 of the high voltage electrical source 30 by a conductor 35. The negative terminal 38 of the source 30 is grounded as at 39. Rods 29 and the cylinder 20 are grounded by conductors 40 and 41 respectively.

The high voltage which is applied between the positively charged shield 31 and the negative form cylinder 10 causes a strong electric field to be formed therebetween. As the positively charged particles of the ink mist 30a enter this electric field, they are repelled by the positive shield 31 and attracted by the negative plate 14, with the result that ink is deposited on the lower surface 20 of web 12 in accordance with the design carried on the plate 14. Since any face 42 of the type or other design 15 is closer to the shield 31 than are the bottoms of the depressions 16, electrified particles of ink are attracted to the face 42 of the type, with the result that ink is deposited on the lower surface 20 of the web 12 at locations directly below the face 42 of the type 15, and is not deposited on the web at points directly below the depressions 16.

As the form cylinder 10 rotates, a new portion of the web 12 and a new design on the plates 14 are rotated into the electric field defined by the shield 31, and this results in the web 19 being printed as it passes over the form cylinder 10.

Figure 3 shows a modified form of printing plate 14' in which the depressions 16, between the raised portions 15 of the type are filled with an insulating material 48 having a high dielectric constant. Placing this material in the depressions 16 is equivalent to increasing their depth, and helps to concentrate the electric field, and thus the ink on the area of the web opposite the face 42 of the type or other design. The modified form of plate 14' shown in Figure 3 of course may be substituted for the plate 14 shown in Figure 2.

A modified form of the invention is illustrated in Figures 4, 5 and 6 wherein the web 12 is forwarded by being passed underneath the roller 11 and then over the top of the form cylinder 10. An ink supplying mechanism 53 is located close to and above the rotatable form cylinder 10. The cylinder 10 and its shaft 13 carry a concentric cam 54, having two low portions 58 and two high portions 59. A cam follower 60 engages the cam 54 to control an electric switch 61, the function of which is hereinafter described. The ink supplying mechanism 53, supported on proper insulators (not shown), may consist of a hopper or V-shaped metallic box 51 having a cover 62, and an opening or slot 63 at the bottom thereof, whereby ink mist 64, produced in the ink supplying mechanism 53, may be deposited on the face 20 of the web 12. Preferably the box 51 may contain a plurality of ink spray nozzles 65 arranged to produce the ink mist 64. Pipes 67 and 68, containing proper insulating joints (not shown), may be employed to supply air and ink to the mist producing nozzles. Due to the force of gravity and the air pressure produced in the box 51 by the spray nozzles, the ink mist 64 is expelled through the opening 63. As best illustrated in Figures 5 and 6, the opening 63 is equipped on both sides with sharp edged troughs 69, running lengthwise of the box 51, which

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through connecting pipes (not shown), carry away any liquid ink which may form on the inside of box 51. Opening 63 is also equipped with a knife shaped electrode 72 supported at 73, running lengthwise of the opening 63, and preferably spaced equi-distant between the two troughs 69. Preferably a high potential source of direct-current 30 is controlled by contactor 74. The metallic box 51 of the ink supplying mechanism 53 may be connected to one contact 75 of the contactor 74 by means of electrical conductor 78, and the other contact 79 of the contactor 74 may be connected to the positive terminal 34 of source 30 by conductor 80.

The negative terminal of source 30 and the form cylinder 10 are grounded by means of conductors 39 and 41 respectively. Solenoid 81, which operates the movable contact of contactor 74, is connected to one terminal of a control power source 82 by means of a conductor 83 and to one terminal of the switch 61 by a conductor 84. The other terminal of the switch 61 is connected to the second terminal of the control power source 82 by a conductor 85. The low portions 58 of the cam 54 are positioned opposite the margin bars 88, located between the edges of the two plates 14. Thus when the cam follower 60 follows into the low portions 58, the switch 61 is opened and the solenoid 81 of the contactor 74 is deenergized, with the result that the high potential source 30 is disconnected from the ink supplying mechanism 53 during the period while the margin bars 88 pass the opening 63 in the box 51. This assures that irregularities caused by the margin bars 88 and the edge of the plate 14 will not appear as printing on the web 12. It will be understood that an electronic contactor having proper grid control can be substituted for the magnetic contactor 74. As in the previously described embodiment of the invention, ink from the ink supplying mechanism is deposited on the side 20 of web 12 opposite from the side 19 which contacts the form 14 and the electric field which is established between the ink supplying mechanism 53 and the form cylinder 10 controls the particles of ink mist 64, with the result that ink is deposited on the web 12 in accordance with the design carried by the form or plate 14. The particles of the ink mist 64 which leave the positively charged ink supplying mechanism 53 carry a positive electrical charge and thus are repelled by the box 51 and are attracted by the negatively charged plate 14 and cylinder 10.

As the form cylinder 10 rotates to carry the plate 14 past the opening 63 in the box 51, the electric field which exists between the box 51 and the face 42 of the form 14 varies as the design on the form or plate varies. This phenomenon is illustrated in Figures 5 and 6 where the design carried on the plate 14 is shown in two different positions with respect to the knife 72 and opening 63.

A further modification of the invention is illustrated in Figure 7 in which a plurality of atomizers 21 (only one of which is shown), have parts formed from insulating material similar to the atomizer 21 shown in Figure 2, and spray atomized ink past the positively charged wire 28 located between the rods 29, which are similar to the wire 28 and the rods 29 shown in Figure 2. The ink mist 30a which is electrified after passing the wire 28, passes between a positively charged knife type electrode 92 and the negatively charged printing plate 14. The electric lines

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of force existing between the electrode 92 and the plate 14 controls the ink mist so that it is deposited on the exposed face 26 of the web 12 in accordance with the design carried by the plate 14. A collection system consisting of an exhaust pipe 93, a reclamation tank 94 having baffles 95, and a suction pipe 96, has been provided in order to remove any excess ink mist 30a which is not deposited on web 12.

A still further modification of this invention is shown in Figures 8, 9 and 10 in which another type of ink supplying mechanism 100 is employed. The web 12 is passed over a roller 11 and under a form cylinder 16 while electrical energy is supplied from the high potential source 30 and the control source 82 in a manner similar to that shown in Figure 4. One of the differences being that the switch 61 is located above the cam 54, and that the ink supplying mechanism 100 is positioned below the form cylinder 16. The ink supplying mechanism 100 is connected to the positive terminal 34 of high voltage source 30 and is insulated from ground by post type insulators 101. A motor 102 drives a pair of rollers 103 by means of belt 104 and pulleys 105. The two large rollers 103 and a small roller 106 are mounted on a frame 109 in the form of a triangle and carry a wide belt 107 having bristles 108 protruding from the outer surface thereof. The lower part of the rollers 103 and the portion of the belt 107 stretched therebetween are immersed in a tray 111 containing a supply of ink. As the belt 107 travels over the three pulleys it carries ink from the tray 111 to a point 112 close to the exposed surface 20 of the web 12. The high potential electric field which exists between the roller 106 and the plate 14 carried by cylinder 10 transfers ink from the bristles 108 to the exposed surface 20 of the web 12. Since the small particles of ink on the ends of bristles 108 are positively charged, they are repelled by the positively charged roller 106 and attracted by the negatively charged plate 14 and thus the web 19 is printed in a manner similar to the method hereinafore described.

The embodiment shown in Figure 10 is similar to that shown in Figures 8 and 9 except that a plurality of separate ink supplying mechanisms 100A, 100B and 100C are spaced around the periphery of the plate cylinder 10. Each ink supplying mechanism is associated with a switch 61A, 61B, and 61C, a contactor 74A, 74B and 74C, a high potential power source 30, and a control power source 82; all being similar to those previously described. By means of these mechanisms it is possible to apply more than one application of ink to the web as it passes over the form cylinder 10. For example, as the web 12 passes around the lower half of form cylinder 10, it receives an initial printing as it passes by the roller 106A of ink supplying mechanism of 100A, and as the same portion of the web passes ink supplying mechanism 100B and 101C it receives a second and third printing. It will be understood that the same design is printed by all three ink supplying mechanisms with the result that the design printed will be more intense than a design formed by one printing. The switches 61A, 61B and 61C cooperate with the ink supplying mechanisms 100A, 100B and 100C respectively to deenergize their respective high voltage source at the instant that the margin bars 88 pass by the rollers 106A, 106B and 106C respectively.

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It will be understood that the invention may be embodied in other specific forms, as for example, it can be arranged to print sheets in place of a web, without departing from the spirit or essential attributes thereof, and it is therefore desired that the illustrated embodiments be considered in all respects as illustrative and not restrictive.

What I claim is:

1. A printing unit for printing on a sheet comprising in combination a form cylinder, a printing plate mounted on the form cylinder and arranged to contact one side of the sheet, at least one ink supplying mechanism, and a means for producing an electric field between the ink supplying mechanism and the plate; the said ink supplying mechanism comprising in combination an ink tray, a travelling belt having a multiplicity of bristles and being arranged to transfer ink from the said ink tray to a point adjacent to the side of the sheet which is not in contact with printing plate.

2. In a web printing unit comprising in combination a form cylinder having a design carried by a plate arranged to contact one side of a sheet of material, at least one ink supplying mechanism, and a means for producing an electric field between the said ink supply mechanism and the plate, and a means for deenergizing the electric field producing means when the edge of the plate is in the neighborhood of the ink supplying mechanism; the said ink supplying mechanism comprising in combination a tray, a travelling belt having a multiplicity of bristles and being arranged to transfer ink from the said ink tray to the point adjacent to the side of the material which is not in contact with the plate.

3. A printing unit for printing on a sheet or web and comprising in combination a form cylinder, a printing plate mounted on the form cylinder and arranged to contact one side of the sheet or web, at least one ink supplying mechanism, and a means for producing an electric field between the ink supplying mechanism and the plate, the said ink supplying mechanism comprising in combination an ink tray, a traveling belt having a multiplicity of bristles capable of supplying ink in the form of small particles and arranged to transfer ink from the said ink tray to a point adjacent to the side of the sheet or web which is not in contact with the printing plate.

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