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Sokolov

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[54] **APPARATUS FOR APPLYING INK AND IMMISCIBLE FLUID TO A PRINTING SURFACE**

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[73] Assignee: **Xerox Corporation,** Rochester, N.Y.

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[52] **U.S. Cl.** **101/147,** 101/336, 101/349

[51] **Int. Cl.** **B41f 7/38,** B41f 7/36

[58] **Field of Search**.....101/147, 148, 450, 451, 136, 101/137, 141, 142, 143, 144, 130, 335, 336, 349

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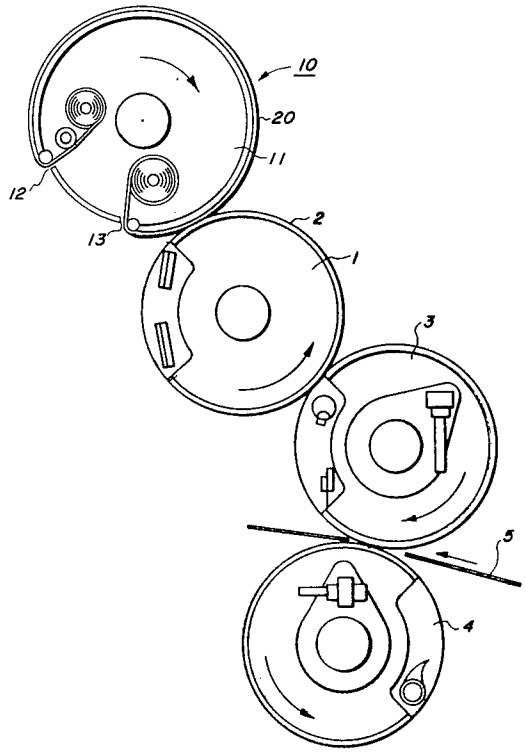
[57] **ABSTRACT**

A method and apparatus for applying an ink-water solution to a surface bearing areas of ink receptivity in image configuration and areas of water receptivity in non-image areas to provide a master for printing duplicate copies of subject matter. The ink-water solution is applied to the master surface by an ink field created by an inking member which includes oleophilic material and hydrophilic material interconnected in a selected form. The ink field supplies a predetermined ink-water solution to the master according to the amount and properties of the ink and water respectively absorbed in the two diverse materials included in the inking member.

2 Claims, 5 Drawing Figures



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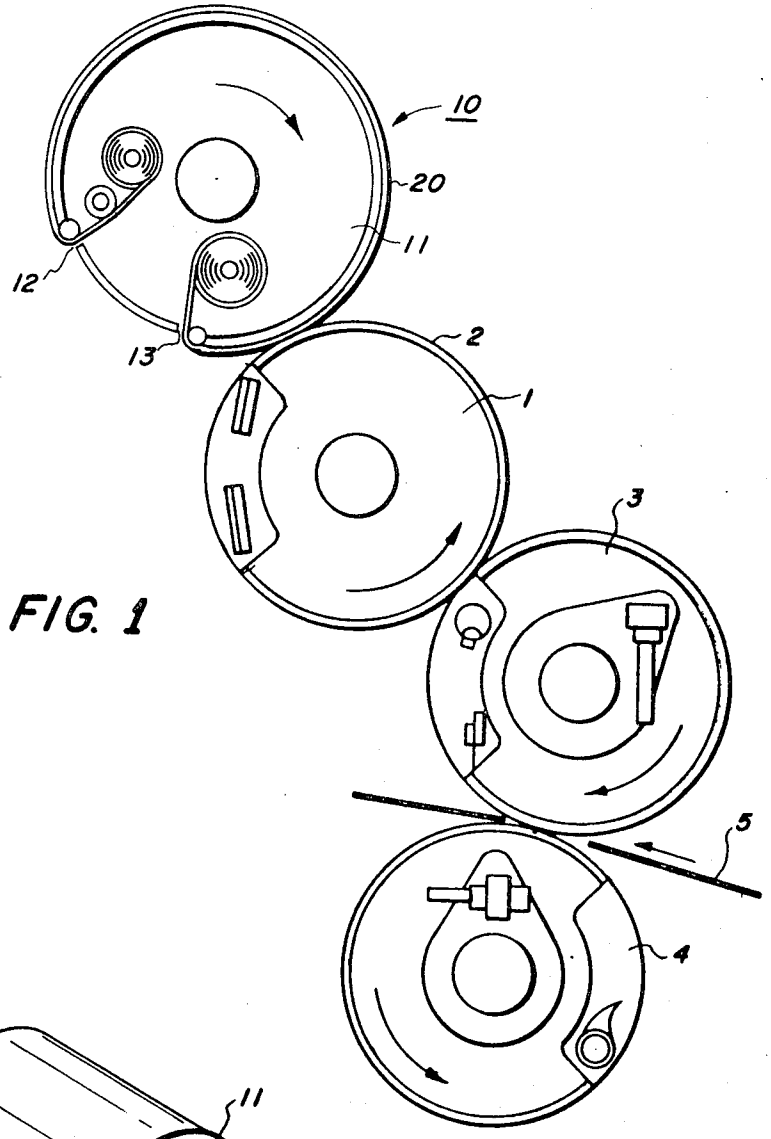

FIG. 1

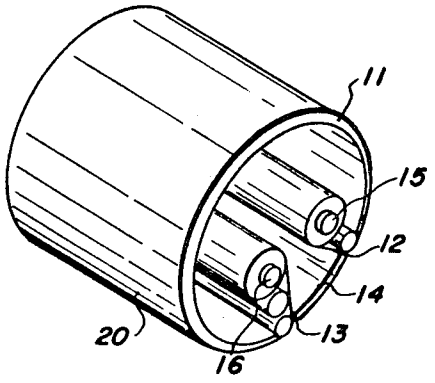

FIG. 2

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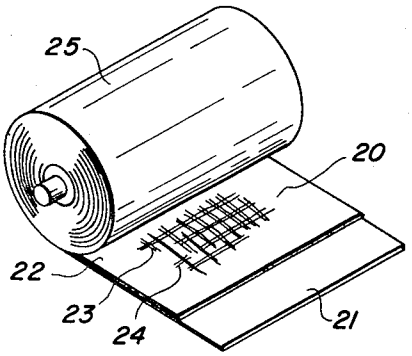

FIG. 3

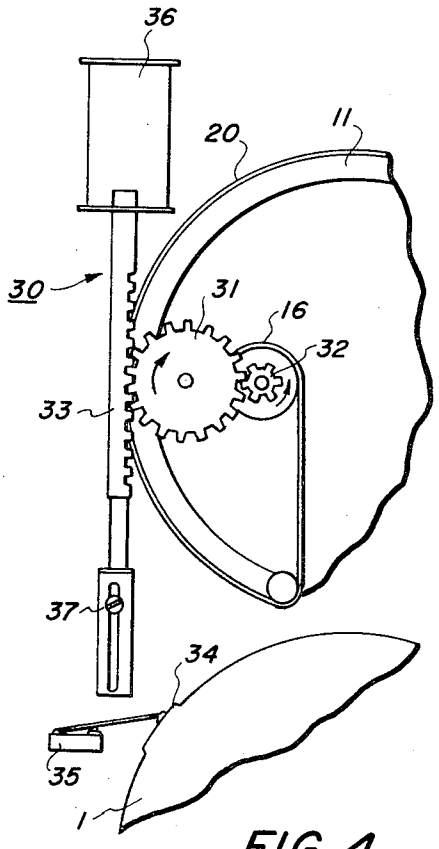

FIG. 4

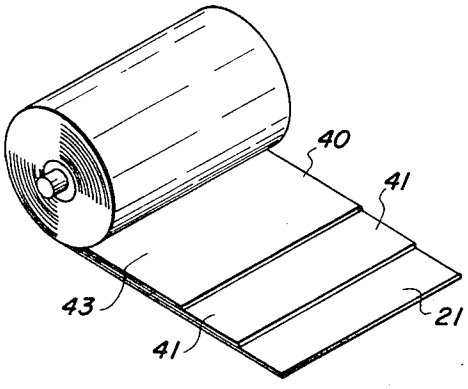

FIG. 5

APPARATUS FOR APPLYING INK AND IMMISCIBLE FLUID TO A PRINTING SURFACE

BACKGROUND OF THE INVENTION

This invention relates in general to the inking of a printing surface and, in particular, relates to a method and apparatus for supplying an ink-water solution to an image-bearing surface from an ink-field including oleophilic and hydrophilic material.

More specifically, this invention relates to a method and apparatus for applying an ink-water solution to an image-bearing surface wherein the ink-water solution to an is supplied by means of an ink-field surface created by the combined properties of oleophilic and hydrophilic material which respectively absorb a predetermined amount of ink and water. The two diverse materials of the ink field release a predetermined solution of ink and water when in contact with the image-bearing surface to provide optimum inking thereof.

Although not intended to be so limited, for convenience of illustration the ink-field applying method and apparatus of the present invention is described for use in the process of offset lithography. In conventional offset lithograph, ink and an immiscible water fountain solution are applied to a master surface which includes areas of ink receptivity in image configuration and water receptivity in non-image areas whereupon the ink receptivity areas thereof absorb the ink solution to create an inked image on the surface while the water solution is absorbed by the non-printing areas. The ink receptive image and water receptive non-printing areas are formed on the master by various well-known methods such as, for example, photosensitive and chemical treatment of the surface and the like. The master surface, after having an ink-water solution applied thereto, supports inked printing areas in configuration of an image of copy to be reproduced which may be transferred in a conventional method to a support material to print duplicate copies. In offset lithography, the master surface transfers the ink supported thereon to a blanket cylinder, referred to as the offset blanket, which, in turn, applies the image to the support material. The inked configuration transferred to the surface of the blanket cylinder is generally impressed on the support material through the utilization of an impression cylinder whereupon the support material passes between the blanket and the impression cylinder to receive the image.

The achievement of clear and satisfactory printing through the process of lithography requires an accurate control of the ink and water fountain solution system so that an optimum solution of ink and water is applied to the master plate to effect proper inking. In prior technology such accurate control of the ink-water system has been through the skilled technique of the operator of the lithographic apparatus. Generally, numerous variables such as the atmospheric conditions, the particular ink and water utilized and the like are encountered and must be compensated for to achieve satisfactory printing results. However, the ink-water solution conventionally has been applied to the master surface by a complex roller train having members with various rotary, intermittent, and oscillatory motions. This complex manner of applying ink and fountain solution requires an extreme degree of adjustment and operator's skill to produce an optimum level of inking of the master to effect desirable printing under the various encountered conditions.

The prior art inking systems also require a periodic cleaning of the roller train and the solution supply containers to insure the efficient operation of the press. Often periodic cleaning encompasses a daily routine which requires an uneconomical amount of operator attention and time in which each roller in the inking means must be stripped of ink, washed with solvent and wiped dry to clear them of any substance which may interfere with the inking process in future printing. The cleaning process is, therefore, a time-consuming and complicated task which is both expensive and inefficient.

Also, the conventional ink-water train utilized in lithographic presses have heretofore taken a significant length of time and operator's technique to commence machine operation. The ink must be loaded into a trough so to be applied to the roller train, and similarly, water must be added to a fountain to be applied to the fountain rollers which supplies the water solution to the master plate. Further, as previously mentioned, the ink and water solution is highly dependent on numerous variable conditions and the initial ink-water preparation must be tested through a stabilizing sequence to determine whether the ink-water balance is correct for producing satisfactory copies. In the prior art, often 20 sheets must be printed and examined with each new master to verify whether the ink balance is correct and this operation must be repeated as each new master is utilized for different reproductions.

Accordingly, the conventional train of rollers and the like to apply ink and immisible fountain solution to a lithographic master plate is a complex system which requires constant attention from skilled operators to achieve satisfactory printing. Not only does the prior art water-ink system require complex starting and cleaning skills, the operator of these systems must constantly be attentive to the ink-water condition during operation of the lithographic apparatus. Therefore, it is desirable in lithography to provide a simple and efficient method and apparatus for applying an ink and water solution to a image bearing surface without the need of skilled personnel to operate the printing device.

SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to improve the method and apparatus for applying an ink-water solution to an image-bearing surface.

Another object of this invention is to apply an ink-water solution to a lithographic surface in a simplified and economic manner.

A further object of this invention is to apply an ink-water solution to an image-bearing surface from an ink field supporting a controlled and consistently balanced ink-water solution.

Still another object of this invention is to reduce the skill required for the operation of a lithographic machine.

These and other objects are attained in accordance with the present invention wherein there is provided an inexpensive and efficient ink-field system which accomplishes lithographic reproduction in a simplified

technique not heretofore possible. The invention comprises an ink-field surface which applies an ink and immiscible water fountain solution to a printing surface in a manner which overcomes the aforementioned problems presented by the prior art methods of inking a surface. The method and apparatus of the present invention utilizes an ink-field member having separate storage mediums respectively mounted, retaining ink and water or fountain solution in a manner to release an ink and water solution when in contact with a surface having an image configuration. The storage medium comprises oleophilic material and hydrophilic material wherein the oleophilic material has an affinity for ink so that ink may be selectively absorbed thereby, and similarly, the hydrophilic material selectively absorbs water or fountain solution. Therefore, the two diverse materials of the ink field respectively absorb a selected amount of ink and water under careful control to provide for optimum inking of an image bearing master under a variety of encountered variable conditions such as relative humidity, temperature and the like. Further, since the ink and water solution are respectively absorbed by the two diverse materials of the ink field under controlled conditions and then are stored in sealed form, a desired ink field may be maintained for an extended period of time until use. Such maintenance of the ink and water in a controlled state eliminates the elaborate and difficult mixing techniques required by the prior art inking process during printing operations.

The ink-field according to the present invention further is in a convenient-to-use form which readily provides an ink and water solution without the need of a highly-skilled operator for the commencing, controlling or cleaning of the inking device. The aforementioned initial copy problem of lithography is alleviated, because the ink-water solution is stored in an optimum state so as to produce satisfactory printing without the need of test copies. Also, because the solution remains substantially constant in its properties, no control of the inking solution is required during printing. Finally, the novel ink field herein described requires no cleaning or disassembly after use, since it has no elaborate structural elements which must be scrubbed or washed. Therefore, the ink field method and apparatus of the present invention is an inexpensive and efficient manner of inking an image-bearing surface with a minimum of difficulty.

Further objects of this invention, together with additional features contributing thereto and advantages accruing therefrom will be apparent from the following description of several embodiments of the invention when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of an offset lithographic machine utilizing the improved ink-water applying apparatus of the present invention;

FIG. 2 is a perspective illustration of one embodiment of ink field apparatus supporting the ink and water supply according to the present invention;

FIG. 3 is a perspective illustration of one embodiment of the ink and water supply according to the present invention;

FIG. 4 is the schematic illustration of a device for advancing the ink and water surface of the present invention;

FIG. 5 is a perspective illustration of a second embodiment of the ink and water supply according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is shown a schematic illustration of an offset lithographic machine utilizing the ink field surface supporting the ink and water supply according to the present invention. A master plate cylinder **1** is rotatably mounted to be rotated by suitable means (not shown) in a counterclockwise direction and includes an outer plate **2** surface having thereon an image of subject matter to be printed. The image on the master cylinder **1** may be created thereon in any conventional manner to provide areas on the surface thereof having ink receptive areas in image configuration and non-image or non-printing areas having water receptivity. The surface area of the master drum including the image configuration rotates into contact with the ink field device **10** according to the present invention (to be described in detail later) to receive therefrom an ink and water immiscible water fountain solution resulting in the image areas of the master to be inked in a desired manner and the water solution to be applied to the non-image areas.

The inked image of the master cylinder thereupon rotates to a position to contact a blanket drum **3** which receives the inked image configuration from the master cylinder. The blanket cylinder **3** is any conventional printing cylinder which carries a suitable blanket material on its surface which will receive the inked image from the master cylinder and efficiently transfer and print the transferred inked image on to a sheet of support material or the like. Conventionally, the blanket material comprising the surface of the blanket cylinder is formed of suitable soft and elastic material which contacts the surface of the support material in a manner to effect efficient ink printing. The inked image transferred to the blanket material is rotated to a position to confront an impression cylinder **4** suitably mounted adjacent the blanket cylinder. A sheet of support material **5**, such as paper, is fed by conventional paper feeding means (not shown) between the impression cylinder **4** and the blanket cylinder **2**. The impression cylinder **4** is biased against the blanket at a preselected pressure to impress the image on the blanket material on to the sheet of support material to provide a printed copy.

Referring now to FIG. 2, there is illustrated one embodiment of the ink field apparatus **10** according to the present invention for applying an ink-water solution to a master having inked receptive image areas and water receptive non-printing areas such as master cylinder **1** shown in FIG. 1. The ink field apparatus includes a rotatably mounted ink field cylinder **11** located adjacent the master cylinder and drivable by suitable means (not shown). The ink field cylinder includes two open slots **12** and **13** on the surface thereof which extend parallel to the axis of rotation of the cylinder and the slots are separated by a removable plate **14** attached to the cylinder. A spindle **15** is mounted within

the cylinder 11 beneath slot 12 and a take-up shaft or roller 16 is suitably located adjacent the second slot 13. An ink field web or roll 20 of the present invention (to be described in detail later) is adapted to be supported on the spindle 15 and extend through the slot 12 to wrap around the exterior of the ink field cylinder 11. The end of the roll or web 20 thereupon is directed through the slot 13 to be attached to the take-up shaft 16, and the surface of the roll 20 thus covers a portion of the exterior of cylinder. The spindle and the take-up shaft are readily accessible through removable plate 14 which facilitates the removal and insertion of the ink field material. It is within the scope of the present invention to support the ink field roll on any other suitable structure capable of applying the surface of the roll to a master surface to be inked other than the specific ink field cylinder herein disclosed.

Referring now to FIG. 3, there is illustrated one embodiment of the ink field roll 20 of the present invention mounted on the ink field cylinder of FIG. 2. The roll 20 includes a continuous sheet 21 of impermeable backing material such as, for example, Mylar or polyester plastic having an overlay of material uniformly impregnated with ink and water solution. Other backing materials may also be utilized with the ink roll such as waxed or coated paper, cloth, sheets of plastic and the like. An inking material 22 is mounted on the backing material 21 comprising a single continuous layer of substrate material which is formed of two kinds of fibers, paper, or other suitable threads evenly cross-woven. One kind of the cross-woven material has an affinity for ink and is termed oleophilic whereas the second kind of material in the substrate has an affinity for water and is a hydrophilic material. In the embodiment of the cross-woven material illustrated in FIG. 3, the oleophilic material comprises the woof fibers 23 thereof while the hydrophilic material are the warp fibers 24 of the substrate. However, it is within the scope of the present invention to utilize woof hydrophilic fibers and warp oleophilic material in the cross-weaved form of the substrate if desired. The relative quantity of the two materials of the substrate depends on the desired solution, the particular material and ink properties, and other encountered variables.

The ink and water are added to the respective cross-woven fibers under controlled conditions in a factory environment or the like. Under the controlled conditions a suitable printing ink which acts with water or fountain water in a suitable manner to achieve effective lithographic printing is absorbed by the oleophilic fibers 23. The selection of the ink is carefully controlled to insure that a quantity of ink is added to the oleophilic fibers to insure optimum printing results for a variety of encountered conditions. Similarly, a carefully selected fountain solution is added to the hydrophilic material 24 to create with the ink absorbed in the other material an optimum ink-water solution. Therefore, under controlled conditions water is absorbed by the hydrophilic material and ink is absorbed by the oleophilic material to produce an optimum ink-water solution stored in the substrate material to be released on the master cylinder during printing.

The roll 22 of the substrate maintaining the desired water-ink solution absorbed by the combined effect of the hydrophilic and oleophilic material is then storable until needed for printing use. The ink field surface 22 supporting the solution is maintained air tight in a rolled form by the combined sealing effect of the backing material 21 and end seals 25. As the ink field roll is needed for use, it is wrapped around the ink field cylinder 11 in the manner previously described whereupon a portion of the ink field substrate 22 forms the outer surface of the cylinder. The ink field roll is then advanced and unreeled by the take-up shaft 16 in a predetermined manner to be explained in detail later. Alternately, the ink field may be encapsulated in a canister container to maintain it in a sealed form if desired.

The rotation of the ink field cylinder 11 and the master cylinder 1 is correlated to place an increment of the surface of the ink field substrate 22 into contact with the image on the master to release and squeeze the optimum prepackaged water-ink solution from the substrate material. The pressure between the ink field cylinder and master extracts a desired degree of water and ink from the substrate and may be adjusted by suitable means (not shown). Therefore, as the master plate 2 having image areas of ink affinity and non-printing areas of water affinity come into pressure contact with the roll 20, ink and water of a preselected mixture is released from the two respective fibers of the ink field surface.

From the foregoing description of the embodiment of FIG. 2, it should be apparent that the ink field created by the ink and water respectively absorbed in the respective diverse materials of the substrate 22 contact with the master plate 2 to provide an easily usable and efficient manner of applying an ink solution to a master 1. Since the ink and water is prepackaged for optimum results, the need for skilled operators to adjust and control the solution for proper inking is eliminated. Further, because the ink-water solution is correctly mixed even upon its initial unwrapping on the cylinder, there is no requirement for an initial run of copies to be made to determine whether a proper ink-water solution is present. Therefore, the initial running of lithographic press may be commenced without the need of test copies to determine the correctness of the solution, nor is such a technique required for any new master plates utilized during the printing operation for any given printing interval.

As the initial length of the ink web field 20 is pressed into contact with the master plate for inking, it should be apparent that the ink-water solution is depleted from substrate 22 after some degree of use. Therefore, it is desirable to advance the web 20 on the ink field cylinder 11 in a manner to apply fresh unused areas of the ink field to the master plate for proper inking of the image thereon. Any suitable means may be utilized in conjunction with the ink field web of the present invention to advance the web at predetermined intervals depending on the degree of use, such as, any suitable mechanism or by hand.

An example of suitable advancing mechanism is illustrated in FIG. 4 to progressively unreel the ink field roll 20 to present unused areas of the substrate 22 into contact with the master plate. The advancing mechanism 30 includes an advance gear 31 rotatably mounted on the ink field cylinder 11 in mesh with a drive gear 32 connected to the take-up shaft 16 supporting one end

of the web 20 of the ink field material. The advance gear 30 moves with the rotation of the ink field cylinder 11 and continuously remains in mesh with the drive gear 32. A rack gear 33 is mounted adjacent the ink field cylinder 11 whereupon the advance gear 31 meshes therewith at a time and location when the ink field web 20 is not in contact with the master cylinder 1. A cam 34 is located on the periphery of the rotating master cylinder 1 to close a microswitch 35 located adjacent the cylinder at the instant the advance gear 31 meshes with the rack gear 33 during rotation of the ink field cylinder 11. The microswitch 35 is coupled between a suitable power source (not shown) and a solenoid 36 connected to the end of the rack gear whereupon the closing of the switch effects movement of the rack gear upward through the energizing of the solenoid at the instant the meshing between the rack gear and the advance gear occurs. Accordingly, the advance gear 31 rotates to drive the roll gear 32 which is rigidly connected to the take-up shaft 16 and unreels a selected increment of the ink roll 20 to expose a fresh unused ink-water increment of substrate 22. The length of movement of rack gear 33 is controlled by a conventional stop means 37 to adjust the increment of unreeling of the ink field roll. The rotation of the ink field cylinder 11 then carries the advance gear 31 from contact with the rack gear which then, in turn, falls back to its initial position.

The advancing mechanism described in reference with FIG. 4 is disclosed for convenience of illustration and other suitable advance mechanisms may be utilized with the ink field roll of the present invention. Further, the advance mechanism of FIG. 4 unreels an increment upon each rotation of the ink field cylinder and master cylinder, but it is within the scope of the present invention to advance the ink field web after a plurality of revolutions of the cylinders depending on the desired printing results. Also, after the ink field web 20 is completely unreeled after extended use, the used web is readily removable from the take-up shaft 16 and a new roll is easily placed on the spindle 15 by removing the removable plate 14 on ink field cylinder 11. The roll of the ink field of the present invention may be of any selected length depending on the amount of printing required, the frequency of use of the printing apparatus and the like.

Referring now to FIG. 5, there is illustrated a second embodiment of the member forming the ink field roll according to the present invention. The ink field roll 40 of the embodiment of FIG. 5 is identical to the roll 20 of the embodiment disclosed in reference to FIG. 3 except that the oleophilic and hydrophilic material of the ink field surface is created by a continuous laminate material 41. The under layer 42 of the laminate 41 is in contact with a backing material 21 which is identical as described previously in regard to the embodiment of FIG. 3. The under layer 41 of the laminate in contact with the backing 21 is, for example, a felt-like material or the like. The overlayer 43 of the laminate is an oleophilic material which absorbs ink and can by any suitable material such as, for example, a sheer acetate fabric. In operation of the embodiment of FIG. 4, the master cylinder is inked by contact with the laminate 41 in the manner similar to that previously described in reference to the substrate 21 in the embodiment of FIG. 2. As the top layer of the laminate contacts the master cylinder, the master is wetted by the fountain solution from the under layer 41 through the interstices of the oleophilic overlayer 43 carrying the ink. Therefore, a water-link solution is applied to the master from roll 40 which, similar to previously described, is prepackaged under controlled conditions. Otherwise, the embodiment of FIG. 4 is storable, operatable and removable in the same manner as the substrate form of the invention previously described.

In the above description, there has been disclosed an improved method and apparatus for applying an ink-water solution to a lithographic master surface. For convenience of illustration, the invention has been described for use in an offset process of lithography. However, the ink field apparatus of the present invention may be utilized in other well-known lithographic processes, such as, direct lithography and the like. Also, the surface to be inked by the instant novel ink field can be in the form of plates or other surfaces other than the cylinders as herein disclosed. Moreover, the substrate embodiment of the ink field surface of the invention may comprise other forms and weaves other than cross-weaving as herein disclosed, and the amount of hydrophilic and oleophilic fibers utilized therein depends on the desired amount of absorption of the respective solution required for satisfactory printing. Similarly, the laminate form of the ink field surface may utilize a top layer of a hydrophilic material and a bottom layer of oleophilic material, if so desired. The ink field created by the two diverse materials of the novel method and apparatus of this invention may be in forms other than a web of material and could be flat sheets, cylinders and the like. It is further within the scope of the present invention to utilize the solution supply material herein disclosed to apply incompatible fluids to any surface having receptive areas to the respective fluids other than in lithography such as in other planographic applications.

While the invention has been described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the true spirit and scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teaching of the invention without departing from its essential teachings.

What is claimed is:

1. An apparatus for applying an ink and ink immiscible fluid to a receiving surface of a printing apparatus comprising;

a. a web of interwoven oleophilic and hydrophilic materials which will respectively retain ink and ink immiscible fluid for release to said receiving surface,

b. means to apply pressure to said web including a cylindrically shaped support surface in proximity to said receiving surface which contacts said web to bias said web against said receiving surface in order to release ink and ink immiscible fluid to said receiving surface, and

c. advancing means which includes mounting means to support said web of material, with a portion of said web extending around said cylindrically

shaped surface and take up means to advance said web incrementally in contact with said receiving surface to provide a continual source of ink and ink immiscible fluid for contact with said receiving surface.

2. An apparatus for applying an ink and ink immiscible fluid to a receiving surface of a printing apparatus comprising:

a. a laminated member with a layer of an oleophilic material and a layer of a hydrophilic material, which will respectively retain ink and ink immiscible fluid for release to said receiving surface;

b. means to apply pressure to said member including a cylindrically shaped surface in proximity to said receiving surface which contacts said member to bias said member against said receiving surface in order to release ink and ink immiscible fluid to said receiving surface; and

c. advancing means which includes mounting means to support said member, with a portion of said member extending around said cylindrically shaped surface and take up means to advance said web incrementally in contact with said receiving surface to provide a continual source of ink and ink immiscible fluid for contact with said receiving surface.

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