United States Patent

Sokolov

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[45] **Sept. 12, 1972**

[54] **LITHOGRAPHIC INKING APPARATUS**

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[52] **U.S. Cl.** **101/147,** 101/336, 101/349, 118/257

[51] **Int. Cl.**.....**B411 25/10,** B411 25/14, B41f 31/24

[58] **Field of Search** 118/257; 101/147, 148, 336, 101/348, 349

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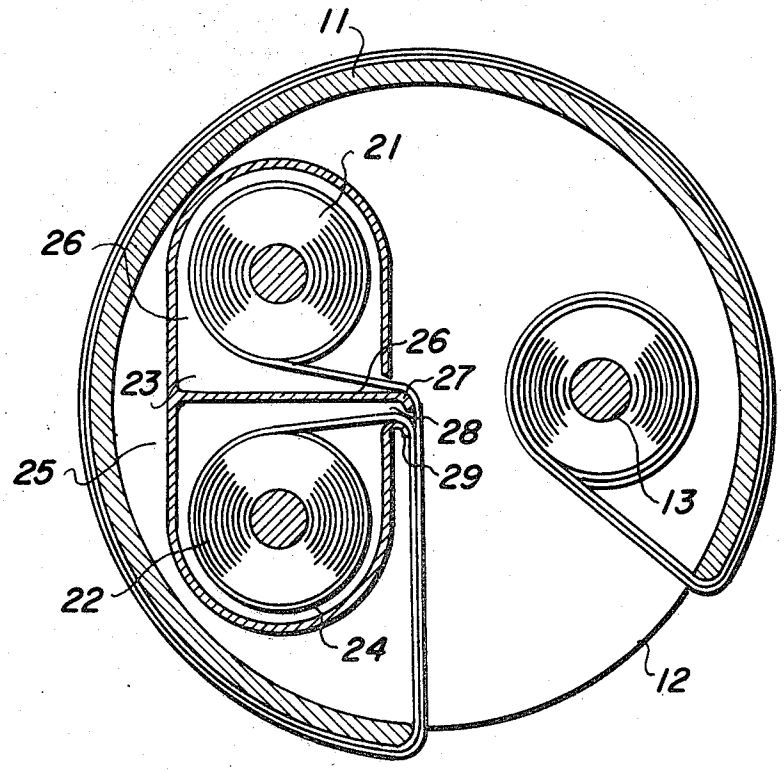
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[57] **ABSTRACT**

An apparatus for applying an ink and water fountain 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 and water fountain solution are respectively absorbed in separate diverse webs of material whereupon each of the webs may be separately stored in roll form until needed for printing. The material of the ink web and the water web is progressively unreeled into pressure contact with the master surface to apply ink to the image configuration and water to the non-image areas.

3 Claims, 7 Drawing Figures



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SHEET 1 OF 4

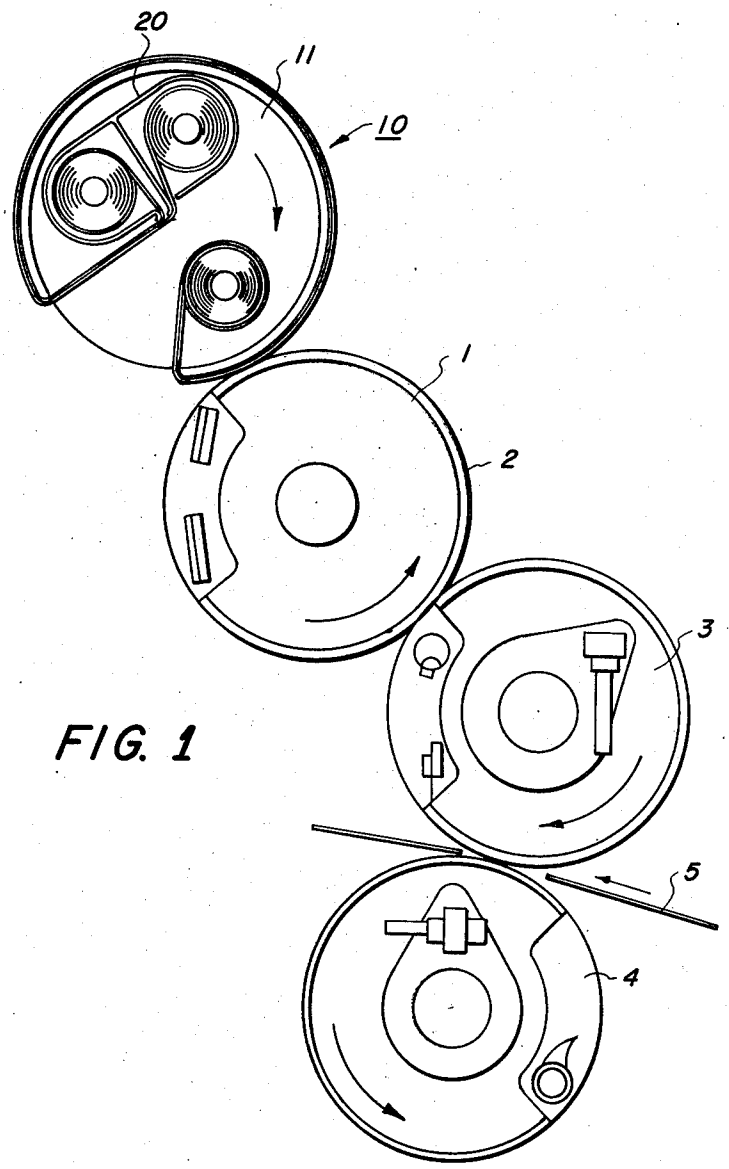


FIG. 1

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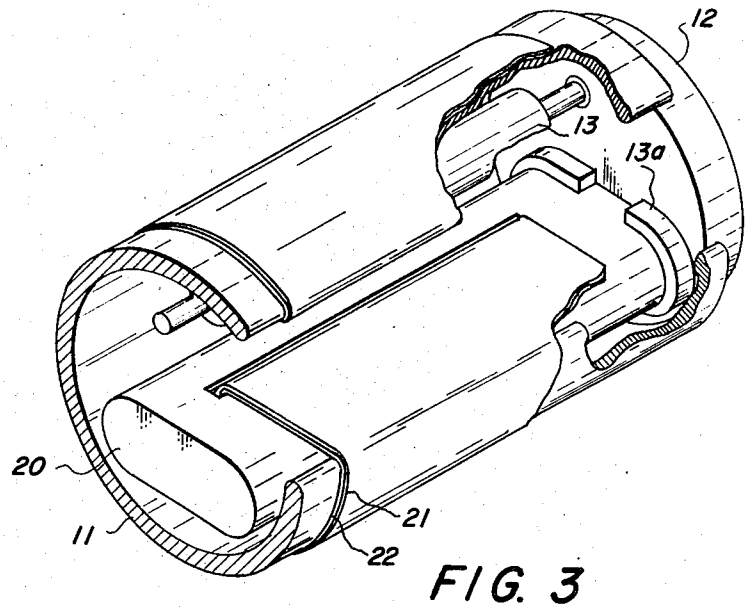


FIG. 3

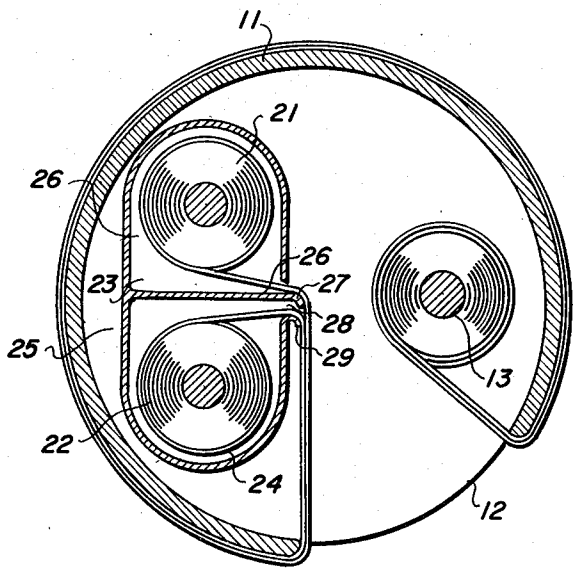


FIG. 2

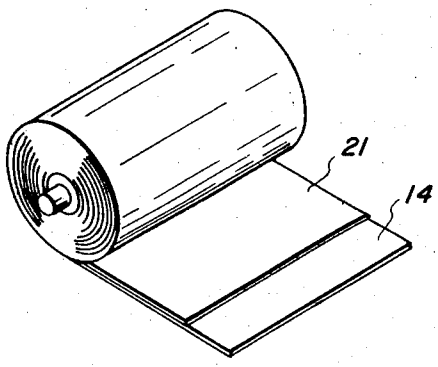


FIG. 4

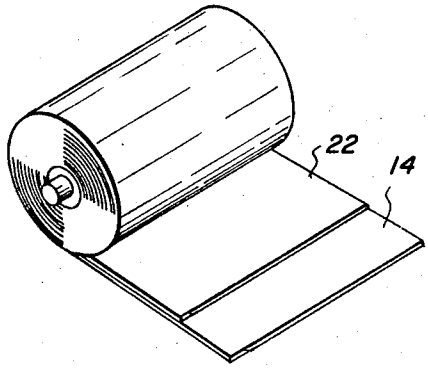


FIG. 5

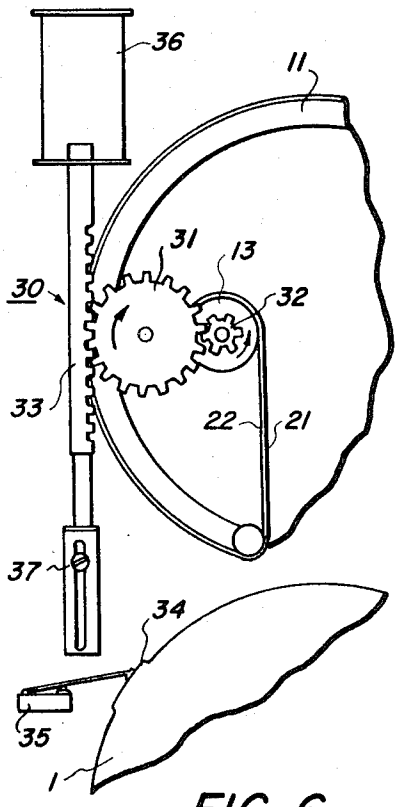


FIG. 6

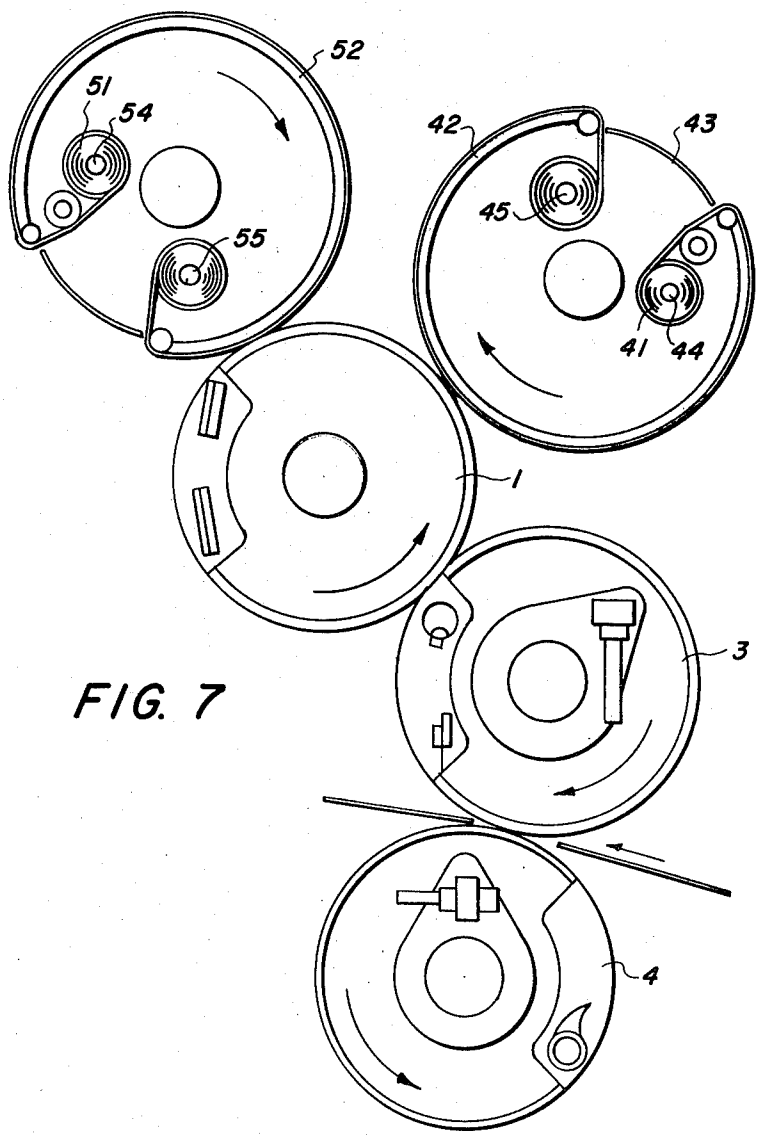


FIG. 7

LITHOGRAPHIC INKING APPARATUS

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 and water fountain solution to an image bearing surface from a storage medium selectively retaining an ink and water fountain solution.

More specifically, this invention relates to a method and apparatus for applying an ink and water fountain solution to an image bearing surface wherein the ink and water fountain solution is supplied by means of an ink supply means created by the absorption of ink in an oleophilic material and water in a hydrophilic material which materials respectively absorb a predetermined amount of ink and water. The predetermined amount of water and ink in their respective storage mediums are separately storable and are adapted to release a predetermined solution of ink and water on the master surface when brought into operational proximity thereto.

Although not intended to be so limited, for convenience of illustration the ink field applying apparatus of the present invention is described for use in the process of offset lithography. In conventional offset lithography, 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 portions. 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 as to be applied to the roller train, and similarly, water must be added to a fountain to be applied to the fountain rollers which supply 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 immiscible 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 apparatus for applying an ink and water solution to an 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 apparatus for applying an ink and water solution to an image bearing surface.

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

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

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

A still further object of this invention is to efficiently maintain the ink and water in the ink storage mediums until needed for printing.

These and other objects are obtained 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 present invention comprises storage means which releases a printing solution of ink and immiscible water upon operational contact with a printing surface. The ink and water are respectively absorbed in diverse material which retains the solution until use. The ink storage medium comprises an oleophilic material which is in the form of a web which readily creates a roll to be stored separately from the water fountain storage medium. The storage medium for retaining the water comprises a hydrophilic material also in the form of a rollable web to thereby facilitate the separate storage and maintenance of the respective rolls until printing. The two storage mediums each absorb a selected amount of ink and water under careful control to provide for optimum inking of the image bearing master under a variety of encountered variable conditions, such as relative humidity, temperature, and the like. The separately stored rolls of the ink and water storage medium may then be simultaneously positioned in contact with the image bearing surface in a laminated form to release an ink and water solution thereon. Alternatively, the ink and water may be applied at two separate stations whereupon the water roll is placed in contact with the master surface and thereafter the ink roll is placed in contact with the surface to provide separate ink and water application.

The maintenance of ink and water in a controlled state through the use of the storage mediums of the present invention eliminates the elaborate and difficult mixing techniques required by the prior art inking techniques. Further, the separate storage of the ink and the water webs provides for efficient maintenance of the printing solution for an extended period of time until needed for printing. The ink field according to the present invention also 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 one embodiment of the improved ink-water solution supply apparatus of the present invention;

FIG. **2** is a schematic illustration of one embodiment of the ink and water supply apparatus of the present invention;

FIG. **3** is a perspective illustration of the embodiment of the ink and water supply apparatus shown in FIG. **2**;

FIG. **4** is a perspective illustration of a form of the roll comprising the ink storage means;

FIG. **5** is a perspective illustration of a form of the roll comprising the water storage means;

FIG. **6** is a schematic illustration of a device for advancing the ink and water rolls of the embodiment of FIG. **2** of the present invention;

FIG. **7** is a schematic illustration of a second embodiment of the ink and water supply apparatus of 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 surface **2** 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 drum **3** is any conventional printing cylinder which carries a suitable blanket material on its surface to receive the inked image from the master cylinder and efficiently 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 onto the sheet of support material to provide a printed copy.

Referring now to FIGS. **2** and **3**, there is illustrated one embodiment of the ink field apparatus and according to the present invention for applying an ink and

water fountain solution to a master having ink receptive areas and water receptive non-printing areas, such as the master cylinder **1** shown in FIG. 1. The ink field apparatus includes a rotatably mounted hollow cylinder **11** located adjacent the master cylinder and driveable in a clockwise direction by suitable means (not shown). The ink field cylinder includes an access opening **12** extending the entire length thereof to facilitate entry to the interior of the cylinder. A take-up shaft or roller **13** is mounted adjacent one side of the opening within the cylinder and also positioned within the cylinder is a cartridge retention means **13A** such as a suitable conventional bracket which will removably support the ink field cartridge **20** of the present invention (to be explained in detail later). The cartridge **20** is adapted to support two webs **21** and **22** of material respectively retaining a supply of water and ink whereby the webs may be extended from the cartridge and wrapped around the outer surface of the cylinder. The ends of the two webs of material are attached to the take-up shaft **13** and thus the two webs wrapped around the exterior surface to form two layers or a laminate on the inking cylinder **11** to provide ink and water for the master **1**. The cartridge retention means **13A** and the take-up shaft **13** are readily assessable through the access opening **12** of the cylinder which facilitates the removal and insertion of the ink supply material. It is within the scope of the present invention to support the webs of the ink and water on any other structure capable of applying the surface of the rolls to a master cylinder surface to be inked other than a specific ink field cylinder **11** herein disclosed.

Still referring to FIGS. **2** and **3**, there is illustrated ink and water supply webs **21** and **22** mounted on the ink cylinder **11** for printing operation. The web **21** is in a roll form and is maintained in a first compartment **23** of a canister storage container **25**. The ink web **21** comprises a continuous layer of oleophilic material whereupon ink is selectively absorbed in the material under carefully controlled conditions. The web utilized for absorbing the ink may be any suitable material which will suitably absorb and retain the ink, such as, for example, a sheer acetate fabric or any other suitable material.

Similarly, the web **22** maintained in a second compartment **24** of the canister **25** comprises a hydrophilic material wherein a carefully selected fountain solution is selectively and uniformly absorbed therein. The continuous web retaining the water solution is a suitable material for absorbing and retaining water fountain solution and may be any material such as, for example, a felt-like material and the like. The relative quantity of the water and ink absorbed in the respective webs is selected to provide optimum results for a variety of conditions depending on the particular material and ink utilized.

The ink and water are added to their respective web materials under controlled conditions in a factory environment or the like. Under these controlled conditions a suitable printing ink which acts with water fountain solution in a suitable manner to achieve effective lithographic printing is absorbed by the oleophilic web **21** of material. The selection of the ink is carefully controlled to insure that a quantity of ink is added to the oleophilic web to insure optimum printing results for a variety of encountered conditions. Similarly, a carefully selected fountain solution is added to the hydrophilic web **22** of material to create in cooperation 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 and are separately stored to be released on the master cylinder during printing.

The webs **21** and **22** containing the water fountain solution and containing the ink fountain solution are packed in the sealed canister **25** having the two compartments **23** and **24** shown in FIG. **2**. The canister **25** comprises any suitable material such as, for example, metal to retain the ink and water in a sealed state until desired for use. The compartments are separated by a metal wall **26** wherein the end of the wall includes a curved lip **27** to allow the web of ink material to readily extend out of an opening **28** of the canister. Similarly, one side of the opening of the canister has a second lip **29** to allow the water web to extend out of the canister without damage. A removable seal (not shown) is utilized to completely seal the canister until needed for use whereupon the seal may be removed to allow access to the two rollers of material therein. As shown clearly in FIGS. **4** and **5**, each of the webs **21** and **22** further include a backing material **14** of a suitable plastic material or the like to provide greater sealing efficiency when the web is rolled and increases the strength of the web.

The canister **25** containing the ink and water rolls is inserted into the ink field cylinder **11** to be secured by the brackets (not shown) therein and the ink and water webs are unreeled around the exterior of the cylinder whereupon the ends of both webs are attached to the take-up shaft **13**. Therefore, the two separately stored rolls containing the ink and water are pulled out together in the form of a laminate whereby the ink roll forms the outer surface and the water roll forms the inner surface. It should be apparent that the canister may take other forms which would suitably store the ink and water rolls. After the initial ends are attached to the take-up shaft, the ink field rolls **21** and **22** are then advanced and unreeled by the take-up shaft in a predetermined manner (to be explained in detail later).

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 and water laminate into contact with the master to release and squeeze an optimum prepacked water-ink solution from the two layers created by the mounting of the two rolls **21** and **22** around the ink field cylinder. The pressure between the ink field cylinder and master extracts a desired degree of water and ink from the two layers and may be adjusted by any suitable means (not shown). Therefore, as a master plate having image areas of ink affinity and non-printing areas of water affinity come into pressure contact with the webs of ink and water, a preselected mixture is released from the two respective layers comprising the ink field surface. During such contact the master is wetted by the fountain solution from the underlayer of the hydrophilic material through the interstices of the oleophilic overlayer carrying the ink.

From the foregoing description of the embodiment of FIGS. **2** and **3**, it should be apparent that the ink field created by the ink and water respectively absorbed in

two rolls 21 and 22 provides a readily useable and efficient manner of applying ink and water solution to a master. Since the ink and water are prepackaged for optimum results, the need for skilled operators to adjust and control the solution for proper inking is eliminated. Further, because the ink and 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 the 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 field comprising the two layers formed from the two separate rolls 21 and 22 is pressed into contact with the master plate for inking, it should be apparent that the ink and water solution is depleted therefrom after some degree of use. Therefore, it is desirable to advance the webs on the ink field cylinder 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 webs of the present invention to advance the webs at a predetermined interval depending on the degree of use, such as, any suitable mechanism or by hand.

An example of a suitable advancing mechanism 30 is illustrated in FIG. 6 to progressively unreel the ink and water rolls 21 and 22 to present unused areas of the laminate into contact with the master plate. The advancing mechanism 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 13 supporting one end of the webs 21 and 22 of the ink field material. The advance gear 31 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 webs 21 and 22 are not in operational 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 advanced gear occurs. Accordingly, the advance gear 31 rotates to drive the roll gear 32 which is rigidly connected to the take-up shaft 13 and unreels a selected increment of the ink rolls and water to expose a fresh unused ink-water increment thereof. 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 and water rolls. 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 advanced mechanism described in reference with FIG. 6, is disclosed for convenience of illustration and other suitable advance mechanisms may be utilized with the ink field rolls of the present invention. Further, the advance mechanism of FIG. 6 unreels an increment upon each rotation of the ink field cylinder 11 and master cylinder 1, 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 desired printing results. Also, after the ink fields webs 21 and 22 are completely unreeled after extended use, the used web is readily removable from the take-up shaft 13 and a canister containing new rolls is easily placed on the brackets (not shown) through the access opening 12 of the ink field cylinder 11. The two rolls 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. 7, there is illustrated a second embodiment of the ink and water applying device of the present invention. The lithographic master 1, blanket cylinder 3, and impression cylinder 4 shown in FIG. 7 are identical to the elements illustrated in reference to FIG. 1. The ink applying means of this embodiment comprises a separate water web 41 and a separate ink web 51 mounted on respective application cylinders. The water roll or web 41 is removably mounted on shaft 44 within a water application cylinder 42 having an access opening 43 to extend to a take-up shaft 45. The water web 41 in this embodiment is identical to the web disclosed in reference to the embodiment of FIG. 2 wherein the roll comprises a hydrophilic material which under controlled conditions absorbs a selected amount of fountain solution. The water web includes a layer of hydrophilic material backed by a suitable backing material such as plastic and the like as illustrated in FIGS. 4 and 5. Therefore, in a rolled form the plastic backing material seals the water web until needed for use, but it should be apparent that the water roll may be sealed in a canister or the like as previously described. The water web 41 is placed within the cylinder 42 on a spindle and is extended around the exterior surface of the cylinder to come into pressure contact with the master 1. The contact of the water web releases a water fountain solution upon the rotating master having ink receptive and water receptive areas whereupon the fountain solution is applied to the water receptive areas and repelled by the image areas having ink receptivity. Thereafter, the master having its water receptive areas wetted with fountain solution moves to come into operational contact with the ink applying means 51.

The ink applying device utilizes an identical support means 52 as water cylinder 41. The web 51 of inking material similarly, as previously described, comprises an oleophilic material whereby an ink solution is selectively absorbed therein having properties and amounts suitable for optimum printing results. A shaft 54 within the ink cylinder 52 supports the roll or web 51 of ink material facilitating its unreeling on the surface of the ink cylinder and the end of the ink roll thereof is attached to the take-up shaft 55 in manner described previously in reference to FIG. 2. Therefore, ink is released upon operational contact with the master sur-

face to apply ink to the image areas thereof to effect printing. Thereafter, the master surface after having the ink and water solution applied thereto by the respective cylinders **42** and **52** moves into contact with the blanket cylinder to achieve printing in the conventional manner.

Each of the rolls **41 91 51** are progressively unreeled on their respective cylinder after extended use to present fresh undepleted areas of material to the master. Therefore, a take-up or advance mechanism such as, for example, described in reference to FIG. **6** may be utilized in conjunction with the instant embodiment of FIG. **7** wherein each cylinder utilizes a separate advance mechanism respectively connected to shafts **45** and **55**. Any other suitable take-up mechanisms or manual means may be utilized in conjunction with the embodiment of FIG. **7** if so desired. Further, the two rolls may be unreeled on the cylinders at the same rate or different relative rates depending on desired printing results.

In the above description there has been disclosed an improved apparatus for applying an ink-water solution to a lithographic master surface. For convenience of illustration, the invention was described for use in the 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 use of the embodiment in reference to FIG. **2** utilized the ink roll forming the top layer in contact with the master and the water web as the underlayer, but it is within the scope of the present invention to use the water web as the top layer and the ink web as the lower layer to contact the master. Also, the present invention may utilize the solution supply materials herein disclosed to apply incompatible fluids to any surface having receptive areas to the respective fluids other than in lithography such as, for example, in other planographic printing techniques.

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 teachings of the invention without departing from its essential teachings.

What is claimed is:

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

a first storage medium adapted to retain ink for release of quantities of ink to a receiving surface upon application of pressure thereto,

a second storage medium separately maintained from said first storage medium retaining a supply of ink immiscible fluid for release of quantities of ink immiscible fluid to the receiving surface upon application of pressure thereto, and

ink and fluid release means including surface means to support an increment of each of said webs in superimposed relationship to apply pressure to the respective increments of said first storage medium and said second storage medium to release ink and ink immiscible fluid to the receiving surface.

2. The apparatus of claim **1** wherein the superimposed increment of said webs are interposed between the pressure contact of said surface means and the receiving surface to release ink and ink immiscible fluid from said increment of said webs respectively.

3. The apparatus of claim **1** further comprising means to advance each of said webs relative to the surface means.

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