July 19, 1966 G. R. BRODIE 3,261,287

LIQUID DISTRIBUTING APPARATUS

Filed Feb. 3, 1964 2 Sheets-Sheet 1

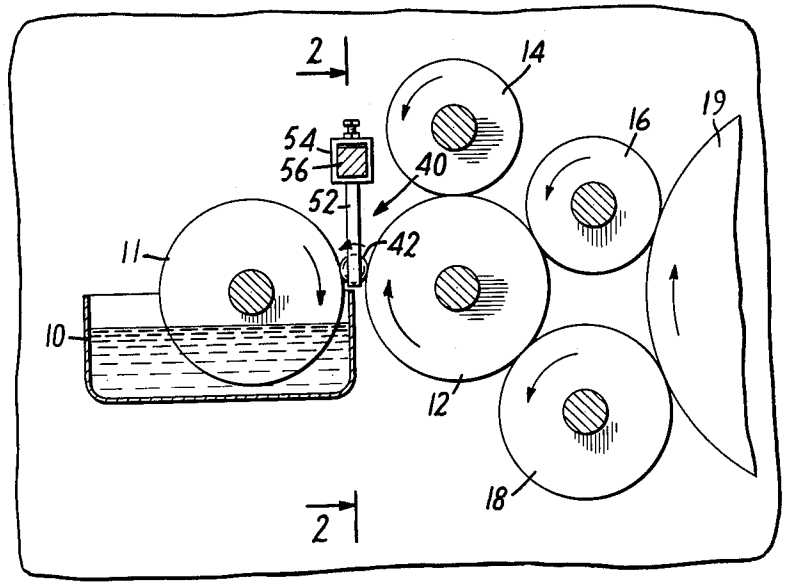


FIG. 1

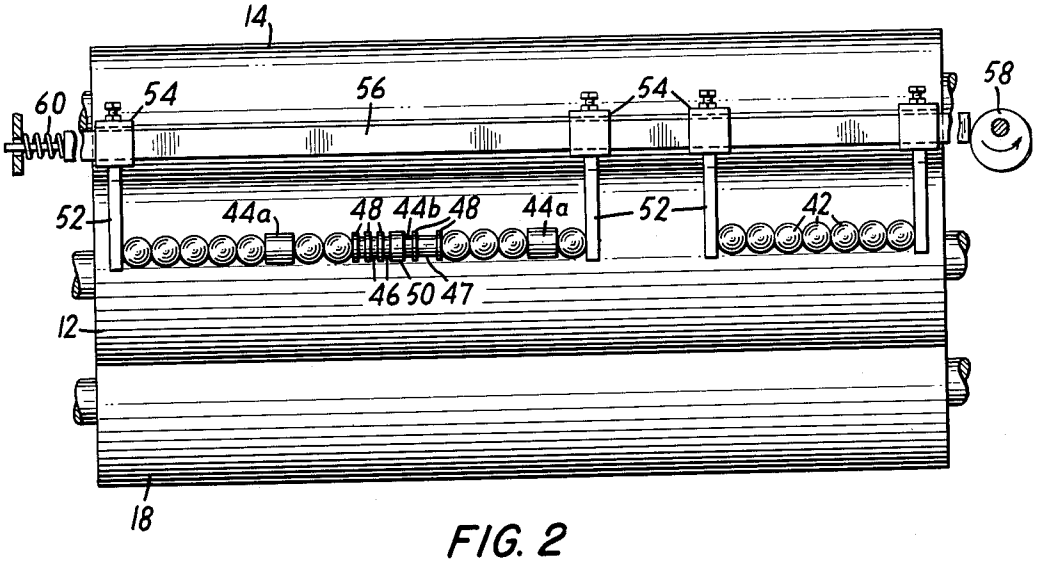


FIG. 2

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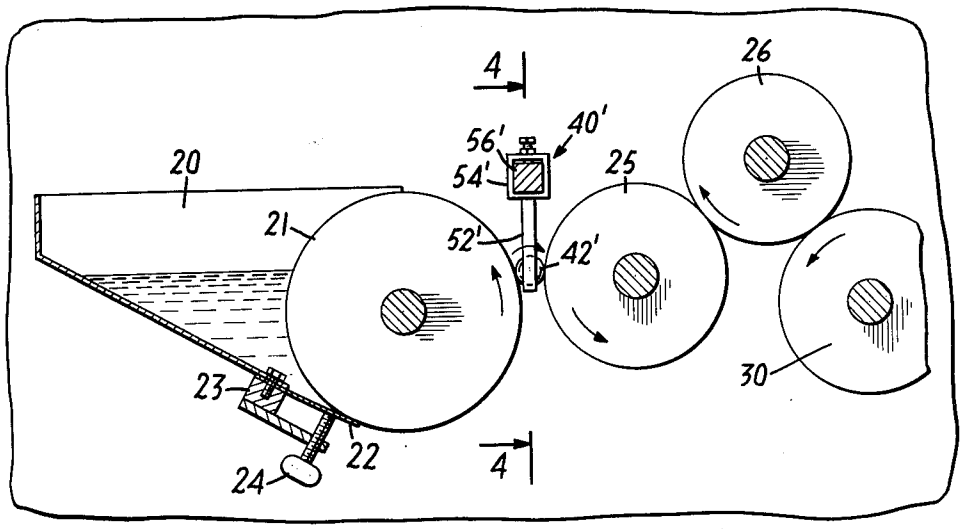


FIG. 3

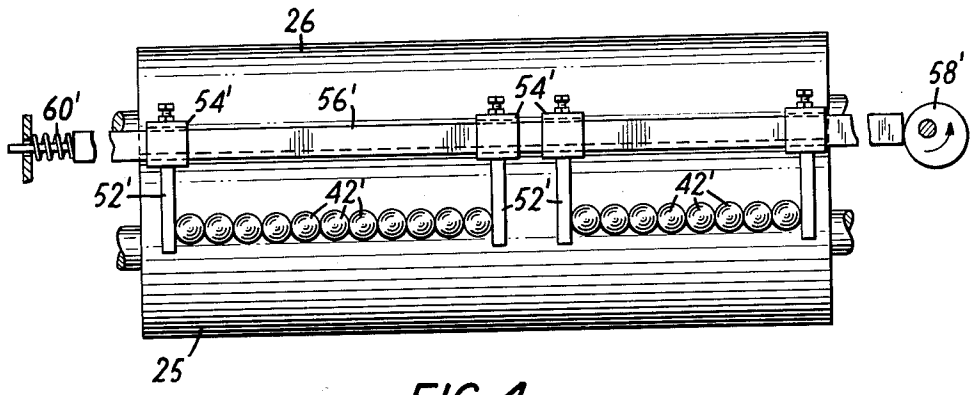


FIG. 4

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LIQUID DISTRIBUTING APPARATUS

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This invention relates to liquid distributing apparatus and, more particularly, to a novel and improved liquid transfer device for liquid distributing apparatus employing distribution rolls or the like to apply a film or coating of the liquid having controlled characteristics to a receiving surface.

As used herein, "liquid" is intended to include all materials susceptible of being spread, smoothed out and conveyed by rolls, such as semi-liquids, pastes, oily masses and the like.

In many processes utilizing thin films of liquid deposition of a film of the liquid from a supply reservoir onto a receiving surface is accomplished by means of distributing apparatus which generally includes a number of rolls for working and rolling out the liquid to provide a uniform film having predetermined characteristics. While it is sometimes possible to use direct contact between a series of rolls to transfer the liquid film from the reservoir to the receiving surface, the transfer of the liquid from a reservoir is usually accomplished by a slowly rotating fountain roll, which is partially immersed in the reservoir and picks up a film of the liquid, and high speed rotating distribution rolls which spread it out and apply it to the surface. It is usually necessary, in systems employing a slow-speed fountain roll and high speed distribution rolls, to utilize some sort of transfer means other than direct contact between the slow speed fountain roll and the first high speed rotating distribution roll, inasmuch as direct contact would not provide the proper transfer. More particularly, direct contact between a fountain roll and the other rolls in the apparatus does not usually afford adequate control over the thickness of the deposited liquid film. Moreover, excessive heat may be generated due to friction at the nip of rolls rotating at different speeds.

Accordingly, means have been provided in most liquid distributing systems for transferring a controlled amount of the liquid from the fountain roll to one or more of the distribution rolls. One form of transfer device is a ductor roll which is oscillated back and forth between contact with the fountain roll and the first distribution roll of the apparatus. Because of its intermittent action, a ductor brings up successive waves of the liquid longitudinally across the first distribution roll. While at least some of the distribution rolls in the apparatus are usually vibrated longitudinally, the longitudinal movement of the rollers is not best suited to smoothing out the wave-like form of the liquid deposited on the first distribution roll, and smoothing out may only be partially accomplished by the rolling motion and transfer between the several rolls. The result is a finished liquid film which is often of varying thickness. Evaporation of solvents in the liquid also presents a problem, inasmuch as adequate smoothing and spreading requires a relatively large number of rolls, thus increasing the area over which the liquid must pass during distribution. It is desirable to keep the number and area of the distribution rolls at a minimum.

Another device for transferring liquid from the fountain roll to the first distribution roll is a rotary brush which contacts the fountain roll to pick up liquid on the bristles. When the bristles are depressed by some means and then released, the liquid is flicked onto the first distribution roll. While a rotary brush does not have the disadvantage of forming wave-like patterns of the liquid on the distribution roll, it is very difficult to control the amount of the liquid transferred, and more viscous liquids cannot be successfully transferred by a brush.

These and other disadvantages of known transfer devices for transferring liquid from a fountain roll to a first distribution roll in liquid distributing apparatus are overcome, in accordance with the invention, by spacing the fountain roll and first distribution roll laterally apart and providing means positioned in the space between them and freely supported by them for transferring a plurality of narrow bands of liquid from the fountain roll to the first distribution roll. Preferably, the narrow bands of the liquid crisscross each other.

More particularly, the transfer means may include a plurality of members having narrow annular surfaces, such as spherical balls or elements having at least one relatively narrow cylindrical surface, which are in contact with the fountain roll and the first distribution roll and are supported thereby, and means for vibrating the members. Additionally, the first distribution roll may also be vibrated longitudinally.

The longitudinally vibrated members pick up liquid from the fountain roll and transfer it to the distribution roll in the form of circumferential lines or narrow bands of the liquid, which in the case of vibration at a uniform rate are transferred in the form of sine wave curves. It is preferred that the members and the first distribution roll be vibrated in opposite directions so that a mass of crisscrossing bands is formed.

As the liquid is transferred between the successive distribution rolls in the distributing apparatus, the crisscrossing lines or bands of the liquid on the circumference of the rolls are spread out and worked into a substantially uniform film which can then be transferred from the last roll or rolls onto the receiving surface. It has been found that the freely rolling members providing the narrow surfaces which transfer the liquid enable a smooth and uniform liquid transfer, unlike the presently known ductor or brush transfer arrangement. A high degree of control of the thickness of the liquid film transferred to the receiving surface is possible.

A principal means of control is the provision of surfaces on the members of various widths, and where it is desired that no liquid be transferred by the system, spaces may be left in which there are no transfer members. Accordingly, the transfer members preferably consist of a member for each narrow band, so that substitutions can be made or blank spaces obtained. In presently known systems, the ductors or the brush must be specifically designed and constructed to provide gaps at the desired locations and selective variation in the thickness of the deposited film.

In distributing apparatus, in accordance with the invention, used for distributing some types of liquids, particularly liquids of relatively high viscosity such as printing ink, means for controlling the pick-up of the liquid onto the fountain roll may be provided, thus enabling a further control of the deposited film. Such means may comprise a flexible blade, extending lengthwise of and spaced from the fountain roll and positioned near the

point where the roll emerges from the liquid in the fountain, and means for selectively adjusting the spacing of the blade from the roll to provide predetermined varying degrees of liquid pick-up longitudinally across the roll. The closer the spacing between the fountain roll and the blade, the less the liquid pick-up and the less the amount of film deposited on the receiving surface. Further control over pick-up on the fountain roll, and therefore over the deposited film, is afforded by varying the speed of rotation of the fountain roll.

Another means of controlling the characteristics of the liquid film is by varying the material from which the members are made. Further, the contact surfaces can be made in various gradations of smoothness from very high polish to a certain degree of dimpling.

For a better understanding of the invention, reference may be made to the following description of exemplary embodiments thereof, taken in conjunction with the figures of the accompanying drawings, in which:

FIGURE 1 is a view in section taken transversely through water distributing apparatus for an offset lithographic printing press;

FIG. 2 is a front elevational view of the distribution rolls and transfer device of the water distributing apparatus of FIG. 1, the view taken generally along a plane defined by the line 2—2 of FIG. 1 and in the direction of the arrows;

FIG. 3 is a view in section taken transversely through a portion of an ink distributing apparatus for a printing press, and

FIG. 4 is a front elevational view of the distribution rolls and transfer device shown in FIG. 3, the view taken along the plane defined generally by the line 4—4 of FIG. 3.

Both the water and the ink distributing apparatus illustrated in the drawings are types which are utilized in conventional printing presses, the water system being ordinarily applicable only in offset lithography but the ink system adaptable to almost all rotary presses. Many variations of the basic apparatus are, of course, well known to those skilled in the art, and can employ the transfer device disclosed herein.

Referring to FIGS. 1 and 2, the water to be coated onto the lithographic plate is contained in a reservoir or, as it is more generally referred to, a water fountain **10**. Partially immersed in the water fountain is a fountain roll **11**, which is rotatable at relatively slow speeds. The speed of rotation of the fountain roll is variable to enable a degree of control over the characteristics of the water film. Adjacent the fountain are distribution rolls consisting of a high speed, longitudinally vibrated first distribution roll **12**, which is arranged generally parallel to and spaced from the fountain roll **11**, a vibrated composition roll **14** contacting the first distribution roll **12**, two form rolls **16** and **18**, and a plate cylinder **19**. In a manner well known to those skilled in the art, the distribution roll **12**, composition roll **14**, and form rolls **16** and **18** spread out water transferred from the fountain roll **11** to the first distribution roll **12** and apply a film of water to the plate cylinder **19**.

Referring now to FIGS. 3 and 4, the ink distributing apparatus comprises an ink fountain **20** having a laterally disposed ink fountain roll **21** which is rotated at slow speeds to carry a coating of ink out of the fountain where it may be transferred to the distributing system. Control of the pick-up of ink on the fountain roll **21** is provided by varying its speed of rotation. Additionally, a flexible blade **22** extending longitudinally across the fountain and carried by a bracket **23** is positioned adjacent the point where the fountain roll emerges from the fountain and forms an extension of the bottom of the fountain. The normal spacing of the blade from the fountain roll is, say, 3/16 in., but keys **24** are provided on the bracket at about 1¼ in. intervals longitudinally to enable adjustment of the blade spacing. Closer spacing of the blade **22** reduces the ink coating picked up and carried by the fountain roll, whereas wider spacing increases the coating.

Disposed laterally of and spaced from the fountain roll **21** is an ink distributing system of generally conventional form. The system includes a first distribution roll **25**, which is usually made of steel, is hard, has a smooth surface, rotates at a relatively high speed, and is vibrated longitudinally. Contacting the first distribution roll **25** is a longitudinally stationary, rotatable rubber roll **26**, which in turn contacts a second steel vibratory roll **30**. Additional vibratory rolls, usually numbering five or more, and additional stationary rolls, sometimes as many as twelve, are provided in the usual forms of ink distributing apparatus.

Similar transfer devices **40** and **40'**, in accordance with the invention, are provided in both the water and ink distributing apparatus to transfer the liquid from the fountain roll to the first distribution roll, and comprise a plurality of spherical balls **42**, **42'** having the same diameters and elements **44***a* and **44***b* having one or more cylindrical surfaces having diameters equal to that of the balls. More particularly, referring to FIG. 2, elements **44***a* are of uniform diameter and are relatively wide, whereas element **44***b* comprises recesses **46** and **47** defining a narrow cylindrical surface **48** and a cylindrical surface **50** of intermediate width. Further, the recesses or grooves **46** and **47** are of varying widths to provide different spacing between the several cylindrical surfaces **48** and **50**. The balls and elements are positioned in the space between the fountain roll and the distribution roll and are supported freely thereby in both the water and ink distributing apparatus.

Groups of the balls **42**, **42'** and, where they are provided, the members **44***a* and **44***b*, are loosely held in contact with each other by arms **52**, **52'**, which are adjustably positioned by clamps **54**, **54'** on a longitudinally extending bar **56**, **56'**, and are vibrated longitudinally across the faces of the fountain and distribution rolls by any suitable means, many of which are known to those skilled in the art, such as by a cam **58**, **58'** disposed at one end of the bar **56**, **56'** and a spring **60**, **60'** at the other end of the bar.

Preferably, the vibrations of the balls **42**, **42'** and elements **44***a* and **44***b* are of phases different from those of the first vibratory distribution roll, and more particularly, the relationship between the vibrations of the transfer device and the distribution roll should be arranged such that the narrow bands of liquid transferred to the distribution roll are in the form of a mass of crisscrossing sine wave curves, thereby providing optimum conditions for the spreading of a uniform film of water onto the plate cylinder in the case of the water distributing apparatus, or of ink in the case of the ink distributing apparatus.

In operation, the various rolls of the distributing apparatus are rotated in the directions indicated by the arrows on the drawings, the fountain rolls, as previously indicated, being rotated at a substantially slower speed than the distribution rolls in both the ink and water distributing apparatus. The relative rotations of the fountain roll and the first distribution roll cause the balls **42**, **42'** and elements **44***a* and **44***b* to roll between them and to pick up water or ink, as the case may be, from the fountain roll and transfer it to the first distribution roll. It has been found that the balls and elements tend to roll at a rate corresponding more closely to that of the fountain roll than to that of the distribution roll, and the amount of liquid transferred varies with the speed of the slow speed roll.

The balls and elements leave narrow bands of the liquid on the first distribution roll, the balls **42**, **42'** leaving lines and the surfaces **46** and **48** leaving bands of varying widths. In this way, the amount of liquid transferred to various longitudinal segments of the distribution roll of predetermined widths can be controlled. Changes in con-

figurations can be made quickly and easily by replacing the balls or elements, and readjusting the arms. Additionally, where it is desired that no liquid be applied to the plate cylinder, the balls **42** or elements **44***a* and **44***b* can be removed from that area and the arms **52** adjusted to hold groups in the remaining areas.

It will be understood by those skilled in the art that the above-described embodiments are susceptible of many variations and modifications without departing from the spirit and scope of the invention. Such variations and modifications are intended to be included within the scope of the invention as defined in the appended claims.

I claim:

1. Liquid distributing apparatus comprising a reservoir containing the liquid to be distributed, first rotatable roll means having a portion immersed in the liquid in said reservoir for picking up a film of the liquid, second rotatable and longitudinally vibratory roll means spaced laterally from and disposed parallel to said first roll means, a plurality of transfer members having narrow annular surfaces positioned in the space between said first and second roll means and supported solely thereby, said members being in light contact with each other and movable relative to one another and said annular surfaces having equal diameters and being spaced-apart longitudinally with respect to said roll means, and means for vibrating said members conjointly longitudinally across and relative to said roll means.

2. Liquid distributing apparatus as claimed in claim **1** wherein said transfer members include spheres having equal diameters.

3. Liquid distributing apparatus as claimed in claim **1** wherein said transfer members include bodies having at least one narrow cylindrical surface thereon.

4. Liquid distributing apparatus as claimed in claim **1**, wherein said means for vibrating said members comprises retaining arms extending generally downwardly adjacent said members and adjustably positioned to retain said members in light contact with each other, rod means for supporting said arms, and means for vibrating said rod means longitudinally with respect to said rolls.

5. Liquid distributing apparatus comprising a pair of rotatable rolls spaced-apart to leave a gap therebetween, a plurality of separate rolling elements unattached to one another and positioned intermediate the two rolls and freely supported thereby one beside the other, said rolling elements bridging the gap between the two rolls and being frictionally driven by the moving surfaces of the two rolls, means including a pair of end supports confining the rolling elements between them in light contact with one another for movement relative to one another, and means for imparting reciprocating motion to the end supports to move them longitudinally of said gap between the rolls, thereby moving the rolling elements back and forth within the gap between said rolls.

6. In a water deposition system for rotary lithographic presses and the like having a fountain containing water, a slow-speed rotatable fountain roll partially immersed in the water for picking up a film of water, and a high speed longitudinally vibratory first distribution roll spaced laterally from and disposed parallel to the fountain roll, the combination therewith of water transfer means comprising a plurality of separate and unattached members having narrow annular surfaces and positioned in the space between the fountain roll and the distribution roll and supported solely thereby for picking up liquid from the fountain roll and transferring it to the distribution roll in the form of a plurality of narrow spaced-apart bands, said members being in light contact with each other and movable relative to one another, and means for vibrating said members conjointly longitudinally across and relative to the distribution roll to form the bands as sine-wave curves.

7. In an ink distributing system for applying a thin film of ink on a plate cylinder of a web-fed rotary printing press or the like, the system having a fountain for the ink, a slow speed rotary ink fountain roll and a longitudinally vibratory high speed rotatable first distribution roll, the combination therewith of ink transfer means comprising a plurality of separate and unattached members having narrow annular surfaces and positioned in the space between the fountain roll and the first distribution roll and supported solely thereby for picking up ink from the fountain roll and transferring it to the distribution roll in the form of a plurality of narrow spaced-apart bands, said members being in light contact with each other and movable relative to one another, and means for vibrating said members conjointly longitudinally across and relative to the fountain and distribution rolls to form the bands as sine-wave curves.

8. The combination according to claim **7** comprising a doctor blade positioned adjacent the ink fountain roll, and means for adjusting the spacing between the doctor blade and the fountain roll along the length of the fountain roll to provide selective variation along its length in the amount of ink picked up by the fountain roll and transferred by the transfer members to the first distribution roll.

9. Liquid distributing apparatus comprising a reservoir containing the liquid to be distributed, first rotatable roll means having a portion thereof immersed in the liquid reservoir for picking up a film of the liquid, second rotatable and longitudinally vibratory roll means spaced laterally from and disposed parallel to said first roll means, said first rotatable roll means having a substantially slower rate of rotation than said second rotatable roll means and the rate of rotation thereof being variable, a plurality of separate and unattached transfer members having narrow annular surfaces and positioned in the space between the first and second roll means and supported solely thereby, said annular surfaces having equal diameters and spaced-apart longitudinally with respect to said roll means, said first and second roll means being positioned relative to each other and having diameters so related such that the transfer members are supported thereby at points on the transfer members lying in a common horizontal plane, and means for vibrating said members conjointly longitudinally across and relative to said roll means to transfer a plurality of criss-crossing narrow bands of the liquid in the form of sine-wave curves from the first roll means onto and extending around the surface of the second roll means, the amount of liquid being transferred between said roll means being controllable by adjustment of the speed of rotation of the first roll means.

10. Liquid distributing apparatus comprising a reservoir containing the liquid to be distributed, first rotatable roll means having a portion thereof immersed in the liquid in said reservoir for picking up a film of the liquid, second rotatable and longitudinally vibratory roll means spaced laterally from and disposed parallel to said first roll means, and transfer means positioned in the space between said roll means and supported solely thereby for transferring a plurality of narrow bands of the liquid from said first roll means onto and extending around the surface of said second roll means, said transferring means consisting of a plurality of separate and unattached members having narrow annular surfaces thereon, said members being freely rotatable and independently supported and driven by engagement of the annular surfaces with said roll means, means for holding said members in light contact with each other and for movement relative to one another, and means for vibrating said members longitudinally across and relative to said roll means, the phase of vibration of said vibrating means being different from the phase of vibration of said second rotatable and vibratory roll means so as to form the narrow bands as criss-crossing sine-wave curves.

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