

July 5, 1966

H. P. DAHLGREN

3,259,062

PROCESS FOR APPLYING A WATER-SOLUBLE ORGANIC DAMPENING FLUID

Filed Nov. 30, 1964

7 Sheets-Sheet 1

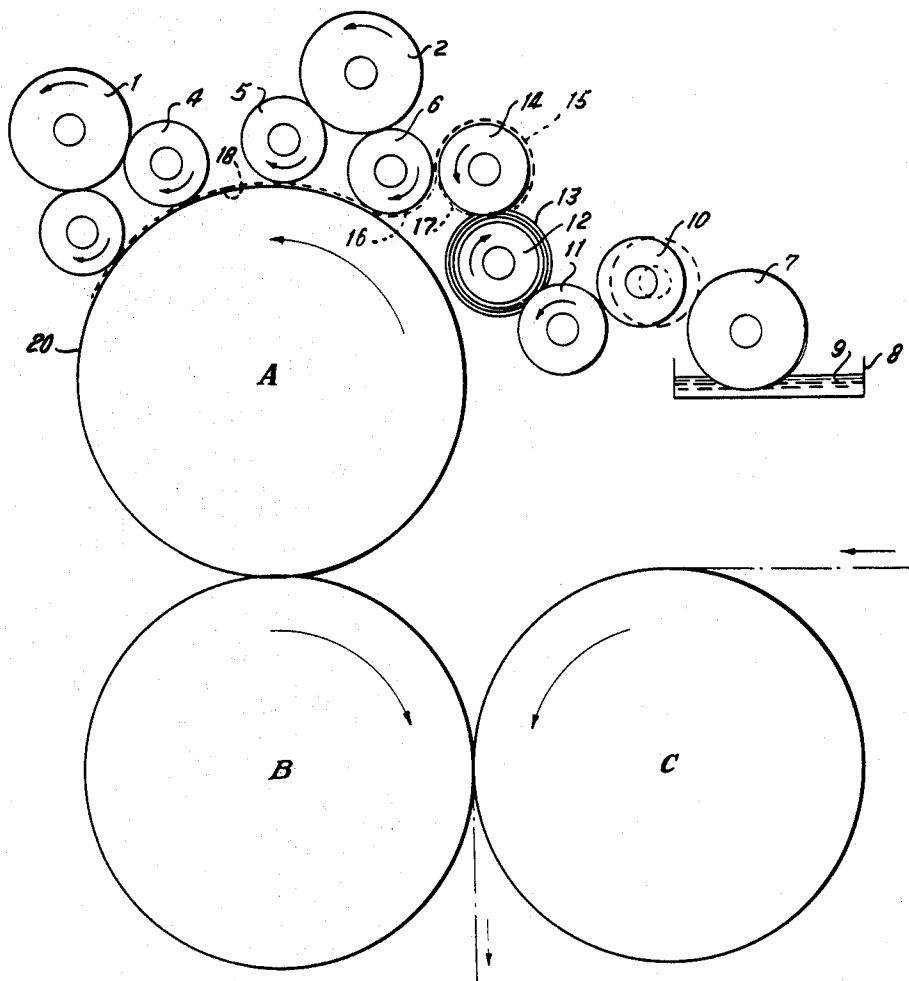


Fig. I

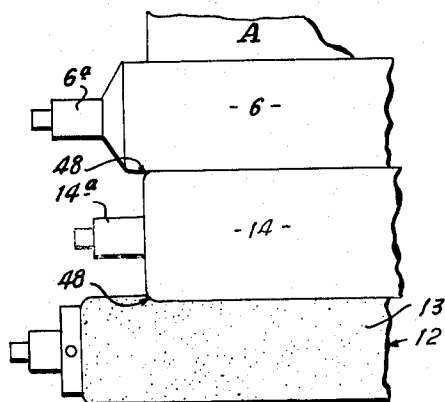


Fig. VII

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7 Sheets-Sheet 2

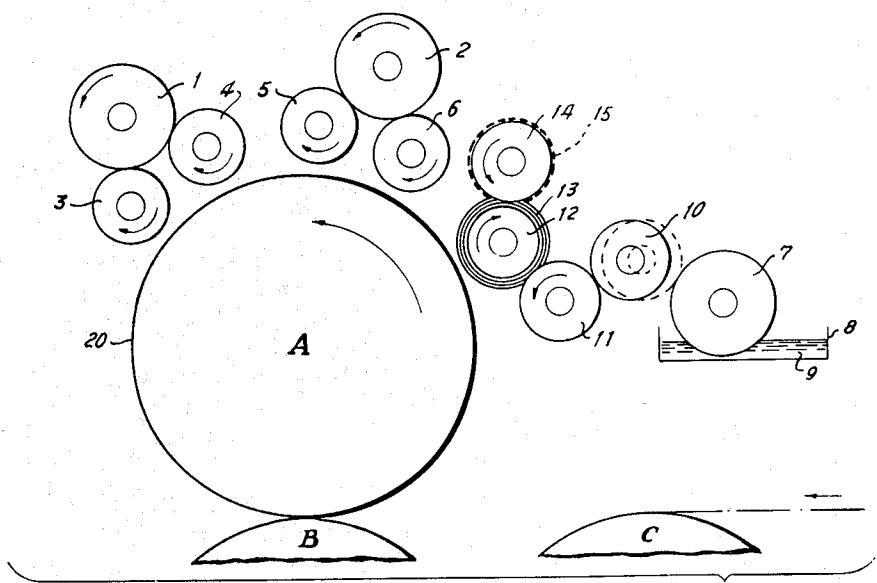


Fig. II

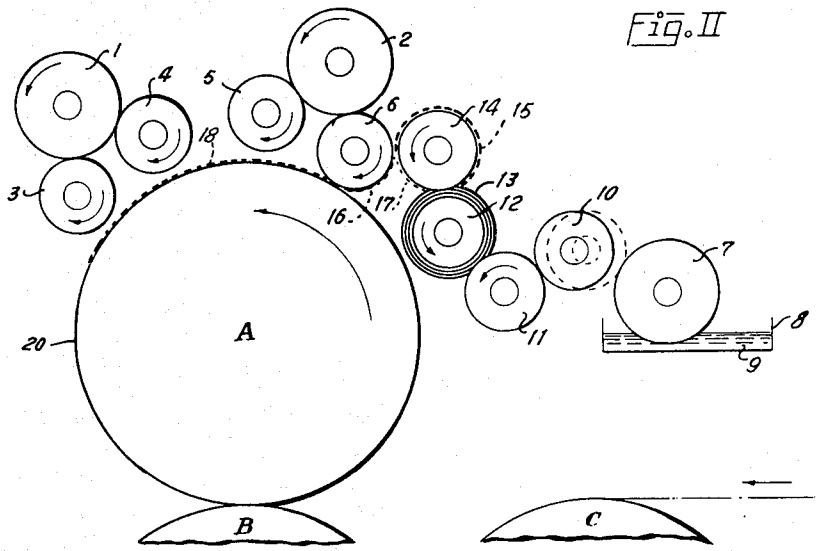


Fig. III

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7 Sheets-Sheet 3

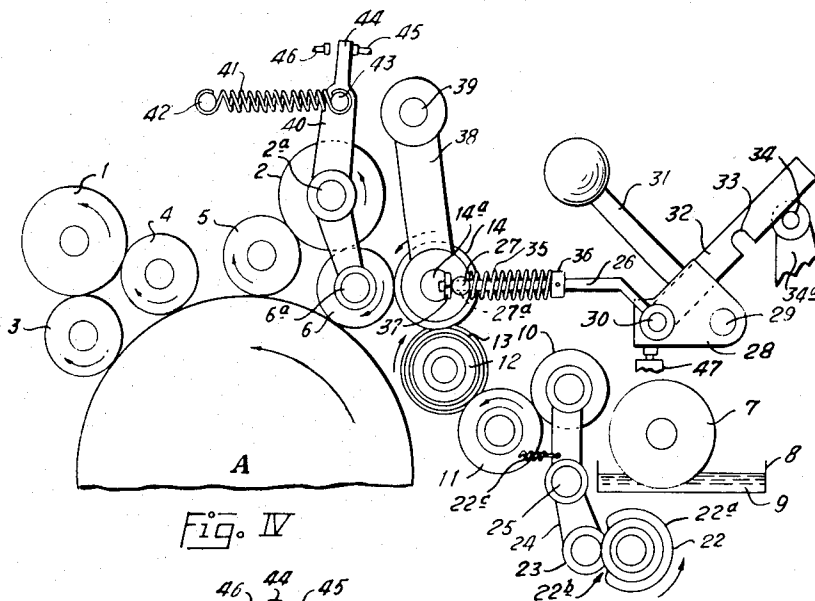


Fig. IV

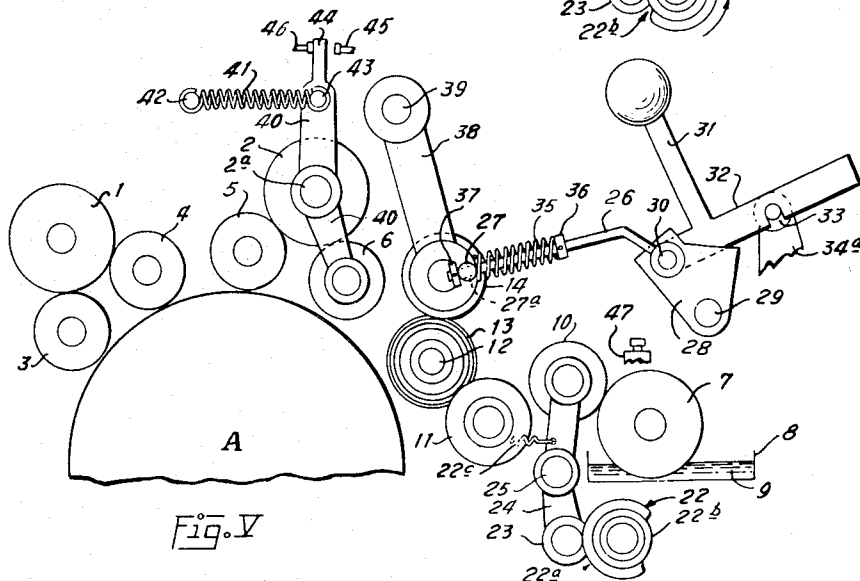


Fig. V

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7 Sheets-Sheet 4

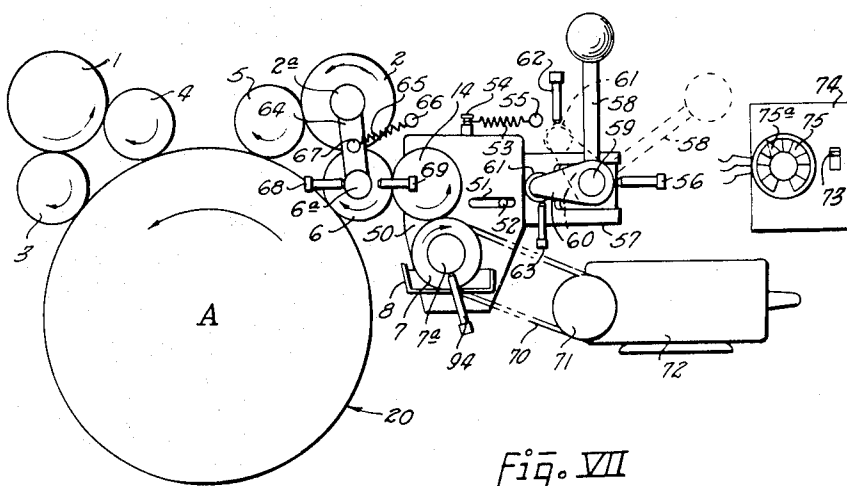


Fig. VII

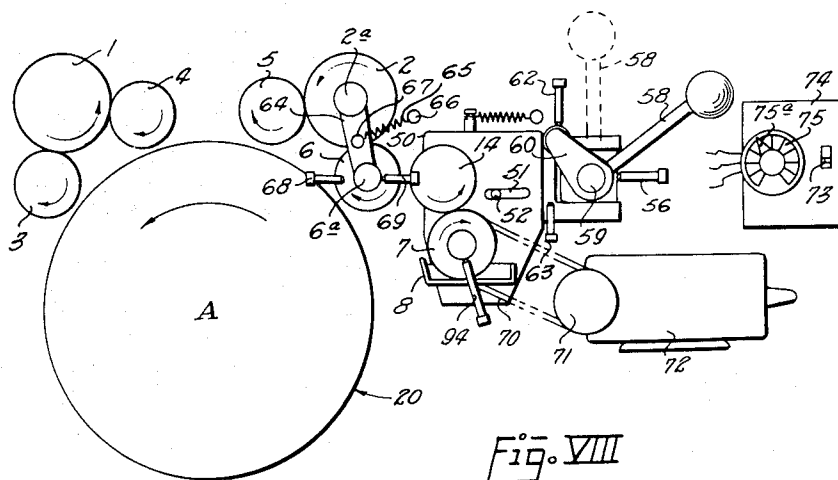


Fig. VIII

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7 Sheets-Sheet 5

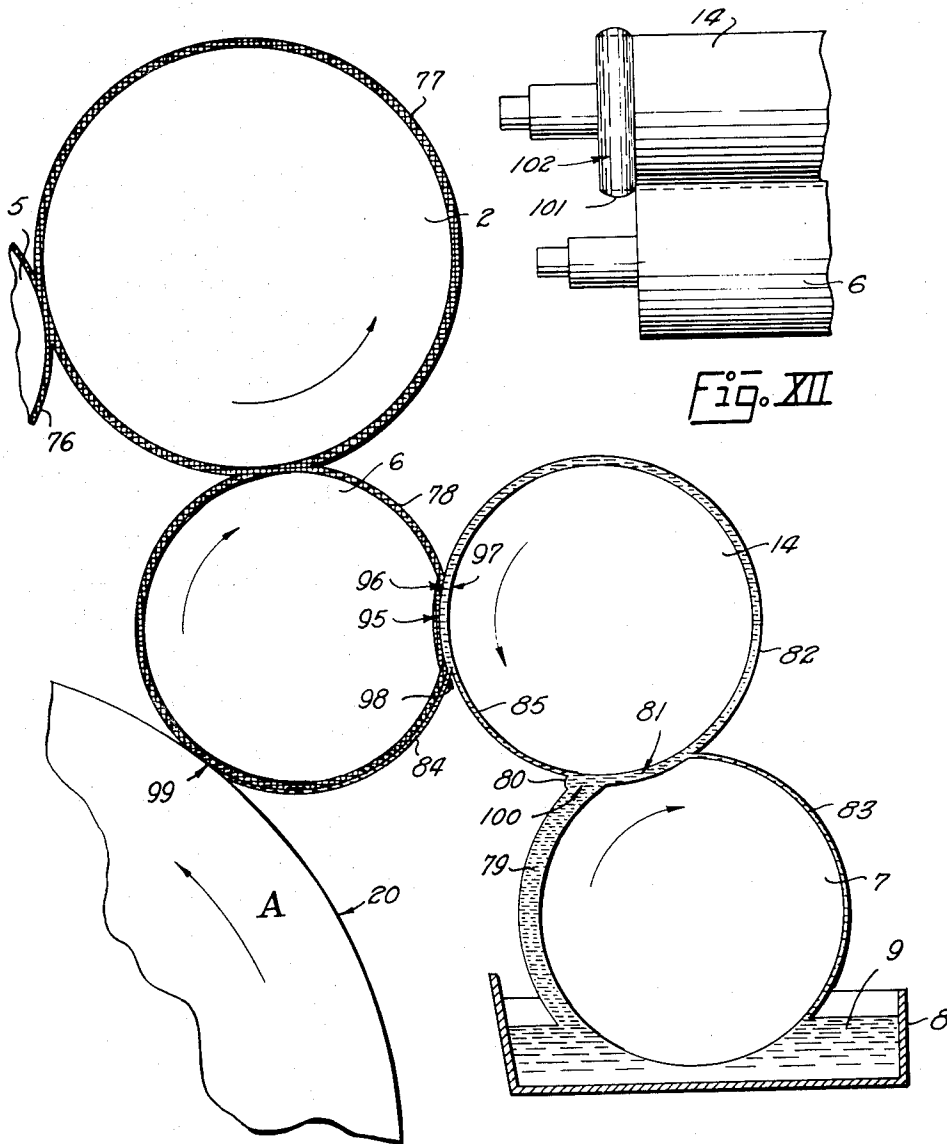


Fig. XII

Fig. IX

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7 Sheets-Sheet 6

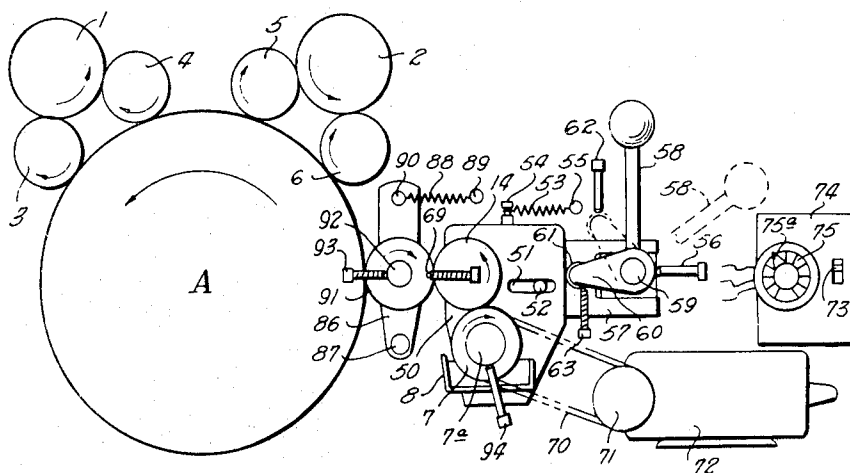


Fig. X

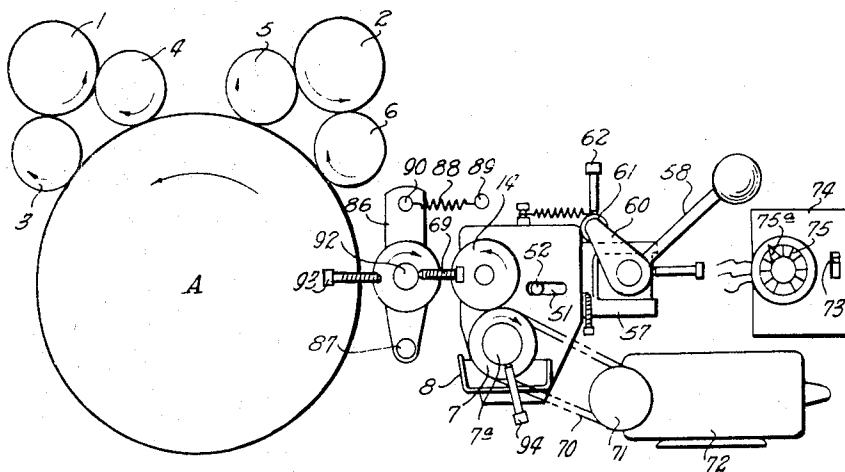


Fig. XI

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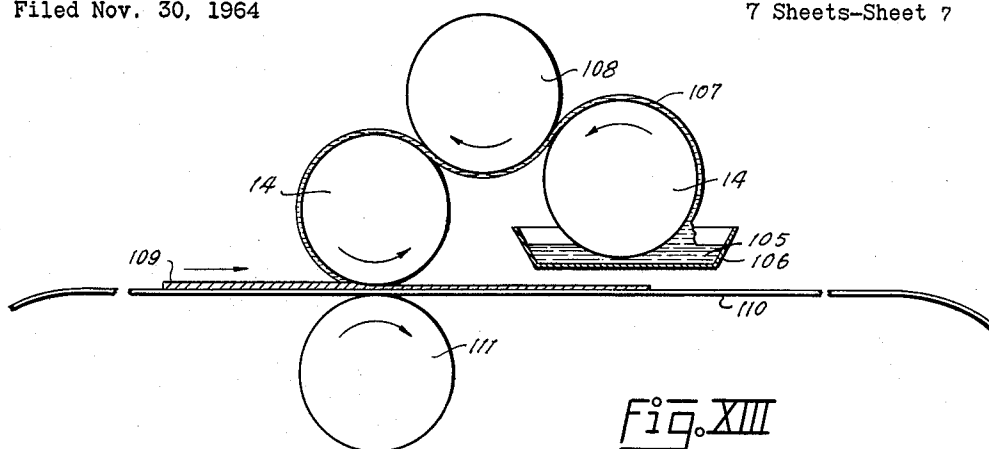
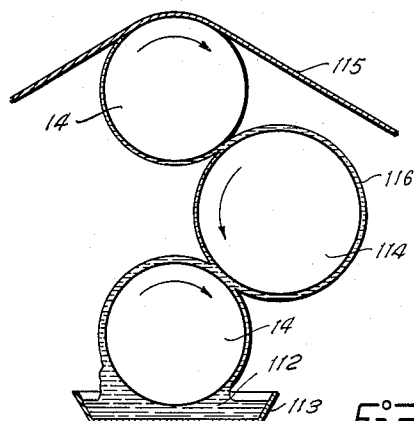
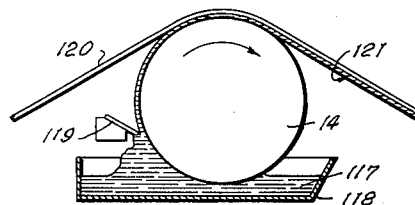
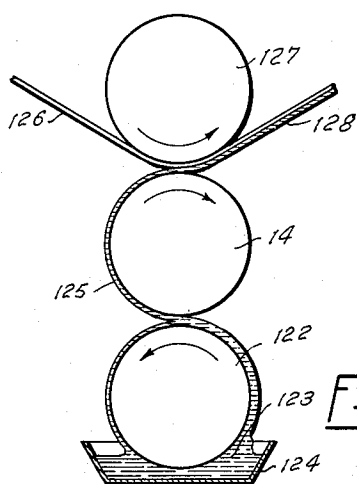
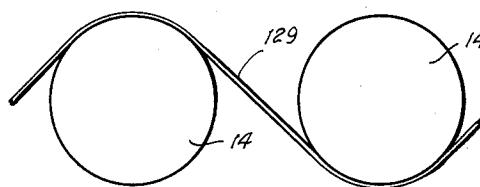
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Filed Nov. 30, 1964

7 Sheets-Sheet 7



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3,259,062

PROCESS FOR APPLYING A WATER-SOLUBLE ORGANIC DAMPENING FLUID

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Filed Nov. 30, 1964, Ser. No. 414,699

6 Claims. (Cl. 101—149.2)

This application is a continuation-in-part of my co-pending application for patent Serial No. 26,035, filed May 2, 1960, and now Patent No. 3,168,037, which was a continuation-in-part of my co-pending application for patent Serial No. 844,372, filed October 5, 1959, entitled "Dampening of Lithographic Offset Printing Plates," now abandoned.

This invention is concerned with lithographic offset printing, and is particularly concerned with improved means for applying dampening fluid to a lithographic offset printing plate and a dampening fluid employed therewith.

A lithographic offset or planographic printing plate is: (1) chemically treated so as to provide a printing area and a non-printing area; (2) the printing area is ink receptive and the non-printing area is hydrophilic or moisture receptive. It is necessary to apply a film of moistening fluid to the surface of the plate which is retained by the hydrophilic area, but is repelled by the printing area so that the printing area receives ink and the non-printing area is separated and isolated from the ink by the film of moistening fluid. Thereby only the image of the printing area is transferred to the blanket cylinder and from thence to the paper on which the image is printed.

One of the greatest problems since the inception of the lithographic offset printing method has been the application of moistening fluid to the surface of the lithographic printing plate in uniform and evenly distributed quantities and in regulated amounts so as to assure uniformly good quality reproduction of the printed image on the paper.

The conventional method now employed consists of a pan of water disposed in parallel relationship to the plate cylinder, with a metallic roller rotated in the water. An oscillating ductor roller alternately rotates in contact with the water pan roller and vibrating metal roller which in turn is in rotative contact with a pair of fabric covered rollers which are in rotative contact with the plate. Moisture is transferred from the fabric covered rollers to the plate, dependent upon the moisture absorbed in the fabric covering material. The plate rotates in contact with a plurality of inking form rollers which are usually urged into contact with the plate by spring pressure.

Ink is prevented from being transferred to the non-image areas of the plate by the film of water separating the non-image areas from the ink on the surface of the form rollers. Since the image areas of the plate are water repellant and ink receptive, ink is transferred to the image areas and in turn is transferred to the blanket cylinder and thence to the paper which is passed between the blanket cylinder and a back up or impression cylinder. The images are transferred to the blanket cylinder in reverse order and are again reversed when transferred from the blanket cylinder to the paper to print an exact reproduction of the image on the plate.

Such a dampening system is subject to many shortcomings which will be briefly mentioned.

The plate is subject to frictional wear by contact with the fabric covered dampening rollers and after many impressions are run the image will become deteriorated and distorted to such an extent as to prevent faithful reproduction of the image.

Furthermore the fabric becomes impregnated and contaminated by the greasy ink which accumulates thereon from continued exposure to the image area of the plate, thus rendering the covering material progressively less

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efficient as a water conductor. The ink impregnated fabric becomes hardened and stiff in certain areas which contributes to the frictional wear of the plate. Also, seam and weave patterns of the fabric are often transferred to the printed sheet due to physical contact with the image area.

This creates an ever-changing condition which must be compensated for by the operator by local applications of additional moisture to excessively contaminated areas, in an attempt to maintain the elusive balance between moisture and ink. This critical moisture and ink balance is essential to consistent high quality printing.

Another factor has contributed to the inefficiency of the system described, that being the emulsification of the ink and water. This is caused by the necessity to feed additional water to the ink impregnated areas of the dampening rollers which supplies an excessive amount of moisture to the less ink impregnated areas, thereby overly wetting these areas. This supplies an excessive amount of moisture to the plate which causes emulsification of the water and ink between the form rollers and the plate. Emulsification causes "washed out," dull colors, retards drying, and causes smudges on the reverse side of the printed sheets, which are stacked one over the other.

One color of ink impregnated into the fabric dampener rollers will contaminate the ink color of a subsequent job if the covers are not washed or changed, thus presenting the never ending, and time consuming problem of changing, or washing, of fabric covers, thus increasing the time and cost of printing by this process.

Another disadvantage of this previous system is that the tacky ink on the plate will pull loose wet fibers from the dampening roller covering material which will lodge on the printing image. Ink will not adhere to the wet fibers thus causing specks on the printed sheet.

Since water is incompatible with ink and is inimical to the transfer of the desired printing image from the plate, it is desirable that the amount of water applied be reduced to the minimum and that only a sufficient amount of water or moistening fluid be applied to form the minimum thickness of film on the non-printing area of the plate to repel the ink and to maintain it ink-free. In the use of the system heretofore described, and due to the undesirable effects thereof hereinbefore expressed, it is apparent that more water enters the system than is desirable, thus multiplying the undesirable effects of water applied in the system, and lessening the printing quality.

This excessive application of moisture, which is antagonistic to ink, and the inking mechanism, is the source of most of the problems inherent in the lithographic process.

The strength of ink colors is adversely effected, drying time of the ink on the sheet is increased, moisture is deposited from the plate surface to the blanket cylinder surface and is absorbed into the paper, causing irregular stacking and curling of the sheets. This excessive moisture causes shrinkage, or expansion, of the sheets upon drying, thus causing varying dimensions of the sheets so as to make subsequent color fittings difficult, if not impossible, on multiple color jobs. Production potential is hampered and quality suffers.

It may be thus concluded that, although dampening fluids play an essential part in the lithographic process by effecting a separation between the ink on the form rollers and the nonprinting plate surface, the excessive application of such dampening fluid is very objectionable.

Many attempts have been made to find the solution for this problem, including among others, the spraying of moisture onto the plate by various means, application of moisture by electrical potential applied to the plate, and the application of moisture through a series of ink rollers one of which is immersed in a pan of dampening solution. None of these attempts have been successful due to the

failure to apply the moisture in uniform and evenly distributed quantities under control, or by reason of emulsification of ink and water.

It is generally agreed that an ideal dampening process would comprise a non-contact type wherein actual physical contact between the plate and the dampening source would be avoided, and the dampening fluid would be applied in such a way as to provide evenly distributed lateral application in optimum amount without constant adjustment, and withoutout transfer of ink back to the dampening mechanism. This would eliminate physical wear of the plate image, would assure that there would be no emulsification and mixing of water and ink, and provide constant automatic control of the amount and distribution of moisture applied.

The present invention provides such a plate dampening system, encompassing the desirable features of uniform, evenly distributed, and desired quantities of dampening fluid applied to the plate, without feed back of ink through the dampening system, and will operate indefinitely without adjustment, eliminating all of the undesirable features of the conventional dampening system which has been described hereinbefore.

In this system of dampening there is no direct contact between the printing plate and the dampening fluid source.

Among the objects of this invention are the following:

(1) A dampening system for lithographic offset printing plates wherein the dampening fluid is applied to the plate in uniform and regulated quantities.

(2) Such a dampening system wherein there is no emulsification of the ink and the dampening fluid.

(3) Such a dampening system wherein the dampening fluid is evenly distributed on the plate.

(4) Such a dampening system wherein dampening fluid is applied to the surface of one of the form rollers by means of a metallic transfer roller having a smoothly polished surface thereon which is chemically treated to render same hydrophilic and means to provide a film of moisture thereon which is split and divided and transferred to the surface of an inking form roller.

(5) Such a dampening system wherein dampening fluid is applied to the plate from the surface of one of the ink form rollers.

(6) Such a dampening system wherein a water soluble, ink attracting, organic liquid is added to, or used as, the dampening fluid to reduce the surface tension of the water in the dampening fluid so as to prevent a water film from collecting in globules on the surface of the form roller when used in conjunction with the highly polished, hydrophilic surface of the transfer roller, and serves as a transfer and bonding agent between the ink on the form roller and the dampening fluid, and as a cooling agent in dampening and other applications.

(7) The use of a water soluble (non-aqueous) organic fluid as a dampening fluid as a subtractive or displacement for water as a dampening agent, thereby lessening or eliminating the undesirable effects of the use of water as a dampening fluid.

(8) The rotation of the transfer roller and the form roller or other roller rolling in contact with the plate at different surface speeds to cause a slippage between such rollers to thereby spread and distribute the film of dampening fluid thereon, to provide regulation of the quantity of dampening fluid applied to the plate, and to wipe out any image which might have been impressed upon the form roller by rotation against the plate.

(9) Means for shifting the water pan roller and transfer roller away from the form roller or other roller in contact with the plate, and for automatically allowing the form roller or other roller in contact with the plate to be shifted away from contact with the plate when the press is shifted in non-impression position, but which maintains the water pan roller and transfer roller in rotative contact in order to assure that a moisture film is main-

tained on the transfer roller while the press is in non-impression position.

(10) The contacting of a film of dampening fluid to a more viscous film of ink between the tangent point of two rollers to cause the splitting of the less viscous dampening fluid to divide and a portion thereof to be transferred to the plate from the more viscous fluid.

(11) Mechanism wherein the axis of the water pan roller and the transfer roller are so arranged that a pile of water or a bead accumulates adjacent to the tangent point of the two rollers so as to provide a reservoir of dampening fluid from which a film of dampening fluid is picked up between the bite of the two rollers as they rotate in contact, and which also provides for absorbing any minute amount of ink which might possibly be transferred from the form roller to the transfer roller while they are in rotative contact.

The invention may be best understood by consideration of an embodiment thereof disclosed in the drawings, and a description of the operation and function thereof.

FIGURE I is a diagrammatic view of the dampening system in printing, or impression, position in conjunction with the plate cylinder, blanket cylinder and back up cylinder on a lithographic offset press.

FIGURE II is a view similar to FIGURE I showing the press in non-impression position with the damping transfer roller separated from the form roller and form rollers separated from plate.

FIGURE III is a view similar to FIGURE I showing the position of the form rollers and dampening system rollers during the preliminary wetting up phase prior to shifting the press into impression position.

FIGURE IV is a view partially diagrammatic showing the operating mechanism for shifting the transfer roller and the moisture applying ink form roller from impression to non-impression position and vice versa. As shown in FIGURE IV, the form rollers and the dampening rollers are in impression position.

FIGURE V is a view similar to FIGURE IV with the dampening rollers and the moisture transfer ink form roller in non-impression position.

FIGURE VI is a fragmentary, elevational view showing the sponge roller, transfer roller and form roller in the relationship they would bear while in rotative contact.

FIGURE VII is a diagrammatic view of a modified form of the dampening system, as it would appear in printing or impression position.

FIGURE VIII is a view similar to FIGURE I showing the press in non-impression position with the transfer roller separated from the form roller and the form roller separated from the plate.

FIGURE IX is an enlarged diagrammatic view showing the relative positions of the water pan roller, transfer roller and form roller, and the films of dampening fluid and ink thereon while the press is in impression position.

FIGURE X is a diagrammatic view of still another modified form of the dampening device employed in conjunction with the method disclosed and claimed herein, wherein a separate roller, which is not a form roller on the press, is employed to transfer the dampening fluid to the surface of the plate.

FIGURE XI is a view similar to FIGURE X showing the modified device with the transfer roller shifted away from contact with the plate contacting roller, and the plate contacting roller shifted away from contact with the plate.

FIGURE XII is an enlarged fragmentary, elevational view showing the spacing of the ends of the transfer roller and form roller, illustrating the water pile at the end of the transfer roller.

FIGURE XIII is a diagrammatic view of a modified form of the dampening device wherein hydrophilic chrome rollers of the type hereinafter described are employed for calendaring sheet material.

FIGURE XIV is a diagrammatic view of still another

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modified form wherein a dampening device employing the hydrophilic chrome rollers are used for dampening a sheet of material.

FIGURE XV is a diagrammatic view of a modified form of device wherein the hydrophilic chrome roller is used in metering fluid and coating a surface on a sheet of material.

FIGURE XVI is a diagrammatic view of another modified form wherein the hydrophilic chrome roller is used in metering fluid and coating the surface of a sheet of material; and

FIGURE XVII is a diagrammatic view of another modified form showing the special hydrophilic chrome roller hereinafter described used in polishing sheet material.

Numeral references are employed to indicate the various parts shown in the drawings, and like numerals indicate like parts throughout the various figures of the drawings.

The letter A indicates the plate cylinder, the letter B indicates the blanket cylinder, and the letter C indicates the impression cylinder, such cylinders being in rotative contact when the press is in operation.

A lithographic offset plate is extended about the plate cylinder A, and a conventional rubber offset blanket is extended about the cylinder B. The paper on which the image is printed passes between the blanket cylinder B and the impression cylinder C as indicated by broken lines and arrows.

Ink is fed to the plate 20, arranged about the cylinder A, through a series of rollers consisting of the ink distributing rollers 1 and 2, usually metal, and having a rigid surface, and the resilient rubber form rollers 3, 4, 5 and 6. Such rollers are in rotative contact so as to distribute the ink fed thereto from a conventional ink supply source and to distribute same on the plate 20 as the plate cylinder A is rotated. A water or dampening solution receptacle or pan 8 extends parallel to the plate cylinder and has a quantity of dampening fluid 9 therein. A metallic pan roller 7, sometimes fabric covered, is rotatively disposed with relation to the pan 8 so that the surface thereof rotates in the fluid 9, picking up fluid from the pan 8.

A ductor roller 10, which is usually fabric covered, is arranged to oscillate between the pan roller 7 and a metallic roller 11 by means of an adjustable cam arrangement which will be hereinafter described. The roller 10 alternately rotates in contact with the pan roller 7 and the roller 11, and picks up moisture from the roller 7 and transfers it to the roller 11. The roller 11 is in rotative contact with a roller 12, which is covered with elastic, flexible, absorbent material 13, such as sponge rubber or plastic. Cellulose sponge material is preferred for this covering material 13. The surface of the sponge roller 12 is impressed into the surface of the roller 11 and moisture is transferred from the surface of the roller 11 and absorbed by the sponge material 13.

The sponge material 13 on roller 12 is impressed against, and is in rotative contact with, hydrophilic transfer roller 14, so as to transfer dampening fluid to the transfer roller 14.

The transfer roller 14 is preferably metal and has an exterior surface which is highly machined and polished and treated so as to render same moisture receptive or hydrophilic. Preferably the surface of the roller 14 is chrome plated, and is polished and treated after chrome plating, so as to render it hydrophilic, and at the same time make the surface perfectly smooth insofar as possible so that no irregularities or coarse surface areas thereof would present a surface for the depositing of ink thereon by reason of the puncturing or breaking of the film or membrane of dampening fluid deposited thereon, as it rotates under pressure with the form roller, as hereinafter explained. Peaks of said irregularities, or coarse surface areas, puncturing and extending through dampening fluid membrane, would contact the ink surface of the form roller, causing transfer of ink back to the dampening

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system. The surface of the roller 14 should be ground and polished to provide a surface smooth finish within a range of .5 to 500 R.M.S. micro-inch. Best results have been obtained with a finish of 5 micro-inch.

It has been found that a chrome surface is readily susceptible to the formation of chromium oxide thereon when exposed to air during normal manufacturing processes, which prevents the surface from being water receptive or hydrophilic. Such chromium oxide also provides a hydrophobic or chemically greasy surface, which would provide an attraction for ink. The treatment hereinafter described is for the purpose of removing chromium oxide from the surface of the transfer roller 14 and preventing same from reforming thereon after such treatment.

One method of treatment consists of bathing the chromium surface with a solution of one part hydrochloric or sulfuric acid, one part gum arabic water solution, 14 degrees Baumé, and one part water. The acid dissolves and removes the chromium oxide, and the gum arabic coats the surface of the chrome to prevent further oxidation. The period of time which the chromium surface must be exposed to this mixture depends upon the time between the chromium plating and machine processing of the surface, and the treatment. The longer the surface is exposed to air the greater will be accumulation of chromium oxide. It has been found that the surface of the roller 14 so treated will pick up a uniform film of moisture 15 from the sponge surface 13 on the roller 12 and such film of dampening fluid on roller 14 is rotated to contact the surface of the ink coating on the surface of the form roller 6.

Even though the acid treatment of the roller is preferable, it is possible that simply grinding and polishing the surface of the roller to remove chromium oxide would be sufficient to render same sufficiently hydrophilic, if not exposed to air for an appreciable length of time before use. Also oil may be applied to the surface of the roller to retard oxidation after polishing, if use of the roller is not immediately anticipated.

The form roller 6 is coated with a film of ink as it rotates. As the roller 14 rotates in contact with the form roller 6 the film of dampening fluid 15, adhering to the surface of the roller 14, is divided. By surface molecular attraction a portion of the dampening fluid 15 adheres to the ink on the surface of the form roller 6, as indicated at 16, and a portion of the film of dampening fluid remains on the surface of the transfer roller 14, as indicated at 17. The film of dampening fluid 16 is in turn transferred to the plate 20, extending about the plate cylinder A, as indicated at 18, to thereby dampen the non-printing area of the plate.

It is important to notice that the dampening fluid film 16 travels only a fractional part of a revolution on the surface of ink form roller 6, and when exposed to the plate surface upon contact between ink form roller 6 and plate A, the dampening fluid is readily given off to the hydrophilic, water loving, plate surface by the less water attractive surface of ink on form roller 6.

Also important to note is that at no time is the dampening fluid passed through an ink roller nip, that is, the tangent, pressure point between two inking rollers, such as the tangent point between roller 2 and form rollers 6. This is avoided to prevent the milling of dampening fluid and ink together, which would cause an emulsification to occur. Emulsification of ink and dampening fluid is the enemy of the lithographer.

Since the surface of the transfer roller 14 and the ink on the surface of the form roller 6 are actually separated by a film of dampening fluid as they are rotated in contact, no ink can transfer from the form roller 6 to the surface of the transfer roller 14 and be fed back onto roller 13 or into the dampening system.

It will also be observed that since the ink is the more viscous fluid than the dampening fluid, the less viscous dampening fluid will transfer to the ink film and the ink

film has no tendency to transfer to the dampening fluid film.

It has been found from experience that due to the surface tension of water, which is customarily used as a dampening fluid, such water has a tendency to form into globules on the surface of the ink on form roller 6, thereby preventing uniform distribution of the dampening fluid on the plate. Therefore, it was found desirable to add to the dampening fluid 9, in the pan 8, material designed to lessen the surface tension of the water so as to prevent the formation of the water in globules on the surface of the ink at point 16.

Conventional wetting agents, such as soap and detergents, were found to be unsatisfactory because they increase emulsification tendencies, retard ink drying, wash out colors and provide other undesirable effects, such as deposition of foreign residual material in inks, and it was necessary to find another material which would not be so objectionable. This material consists of a water soluble, volatile organic liquid such as alcohol, esters, ketones, and similar compounds which are compatible with, and receptive to, oil-based ink as distinguished from conventional ink-repellant dampening fluids. Alcohol is preferably employed because of its economy and ready availability. Such material is molecularly compatible with the ink on the surface of roller 6 because the vehicle of the ink is organic material and the dampening material is organic material.

Preferably a watery, highly volatile alcohol such as ethyl alcohol, methyl alcohol or isopropyl is used. Glycerin, although classed as an alcohol, is generally unsatisfactory because it has an oily base, does not readily evaporate, and absorbs moisture from the atmosphere.

Such organic liquid was found to have other advantages in the lithographic printing process, and the higher the percentage of such liquid to water employed, the greater the advantages enjoyed. It has been found that as low as 10% mixture with water works satisfactorily. The use of such liquid, particularly alcohol, without water, produces superior results.

It is desirable, however, that some water be used with the water soluble organic liquid for reasons of economy and safety. Furthermore, water retards evaporation of such highly volatile material, causing the supply of moistening material to last longer and provides more uniform control over the amount of dampening fluid material applied.

Such materials provide many advantages in that upon evaporation they do not leave any residual materials, which are often present in the water, the evaporation is more rapid, thereby reducing sheet curling and distortion, they do not affect the ink or cause deterioration thereof, they do not affect colors as does water, and drying time is reduced, thereby eliminating smearing or offsets on the back sides of the printed sheets, and more brilliant colors are rendered possible on printed sheets with a thinner layer of ink.

Due to the undesirable effects of the use of water as a dampening fluid in the lithographic process, it is apparent that it would be desirable to lessen or entirely eliminate the use of water and substitute therefor a dampening fluid which does not have these undesirable effects.

It has been found that the water soluble organic liquids, referred to above, provide a much more effective dampening fluid which does not have such undesirable effects. These liquids will work in the lithographic process alone or without the additive of water, and may be truly characterized as a subtractive or displacement for water.

It has been found that such water subtractive or displacement liquids have a greater affinity for the hydrophilic or non-image area of the plate, and thereby provides a more effective dampening agent.

With the rapid growth of the lithographic industry in recent years, the paper making industry was forced to

develop papers and paper coatings which could resist the disintegrating effects of water. These coating materials for lithographic printing paper are generally referred to as "offset enamel," and it is admitted by paper making chemists and technicians to be inferior as a recipient of ink.

Papers and paper coatings made for other printing processes without the special offset enamel coating, do not have sufficient wet strength to withstand the influence of water absorbed during the printing operation in a lithographic press. Under pressure from the water moistened rubber blanket, the coatings on enamel papers, used in ordinary letterpress printing, will dissolve and adhere to the blanket, causing fibers of sheets to separate and split, and the sheets to curl, distort and tear.

It has been found that by the use of the above mentioned water soluble organic liquids as a water displacement, ordinary letterpress paper can now be printed with the lithographic process at a much reduced paper cost and with superior printing quality. For instance, a third class letterpress enamel sheet can, due to its more ink-compatible surface characteristics, produce a more superior color reflection than a first class lithographic or offset enamel sheet which has less ink-compatible surface characteristics. Therefore, by the elimination or lessening of the use of water, the cost of the lithographic printing process has been lessened and at the same time produces a superior quality of printing.

The dampening fluid of the type described above is compatible with and attractive to oil-based ink as distinguished from ink repellent dampening fluid heretofore used. It provides a bonding agent between the dampening fluid and the ink on the surface of roller 6, and makes it possible to transfer dampening fluid to the plate on the surface of ink on an ink carrying form roller. This could not be done with conventional dampening fluid heretofore used.

The dampening fluid heretofore described provides many other advantages among which are, the specific gravity of the dampening fluid is reduced and reduces the film thickness of the dampening fluid more quickly, and continuously reduces the film thickness as the dampening fluid is applied, it is more quickly absorbed in the inking system because it is ink compatible and rides on the surface of the ink form rollers in a uniformly thin layer and evaporates quickly, when it evaporates it does not cause oxidation as does water and provides a cooling agent for the rollers running in contact.

It is desirable in the use of the dampening process herein described that when the press is shifted to non-impression position, and is idling during the replenishment of paper stock, or for other reasons, that the transfer roller 14 be shifted away from the form roller 6 so as to prevent the accumulation of moisture on the form roller 6 and the feeding of same back through the series of ink rollers with which it is in contact. At the same time it is desirable that the transfer roller 14 be continuously supplied with dampening fluid so that the press will be immediately ready for operation when shifted back to impression position.

It is also desirable that prior to shifting the press back to impression position that the surface of the form roller 6 be dampened and be brought into contact with the plate to dampen same prior to shifting the other form rollers back to rotative contact with the plate.

Therefore, in FIGURE II, the press is shown in non-impression position, with the transfer roller 14 shifted away from the form roller 6, but still maintained in rotative contact with the resilient sponge surface 13 on the roller 12, and the dampening fluid mechanism is still in operation supplying dampening fluid to the transfer roller 14.

In FIGURE III the form roller 6 is shown shifted back to rotative contact with the plate but the remaining form rollers 3, 4 and 5 remain separated from the plate. The

transfer roller 14 has been shifted back into rotative contact with the form roller 6 in order to deposit dampening fluid on the ink surface of the form roller 6 and the plate surface prior to shifting the press to full impression position. This arrangement assures that the surface of the transfer roller 14 is maintained with a film of dampening fluid on the surface thereof at all times so that no ink can be fed back to its when it is shifted to engagement with the form roller 6, and also assures that the non-impression areas of the plate are properly wetted before the press is shifted to impression position, thereby assuring that no ink will be deposited on the non-image area of the plate and that good quality printing is attained at the beginning of the feeding of paper into the press.

In FIGURES IV and V there is shown suitable mechanism for shifting the transfer roller 14 away from, and into engagement with, form roller 6, and for shifting form roller 6 away from, and into engagement with, the plate separately from the shifting of the other form rollers 3, 4 and 5 into or away from engagement with the plate.

As shown in FIGURES IV and V a rotatable cam 22 is provided for alternately shifting the ductor roller 10 between the pan roller 7 and the transfer roller 11. This arrangement includes a cam arm 24 which is pivoted about a shaft 25.

A cam follower roller 23 is mounted on the lower end of the arm 24, and such roller is spring urged into contact with the surface of the cam 22 by a spring 22c. The ductor roller 10 is rotatably mounted at the upper end of the arm 24. It will be apparent that as the larger radius 22a of the cam 22 contacts the cam follower roller 23, the ductor roller 10 will be pushed into contact with the pan roller 7 and that when the cam follower roller 23 engages the reduced radius 22b of the cam 22, the spring 22c will pull the ductor roller 10 into contact with the transfer roller 11. Thereby the ductor roller 10 alternately contacts the pan roller 7 and the transfer roller 11 to transfer dampening fluid from the pan roller 7 to the transfer roller 11.

The elbow spring rod 26 is pivotally connected by a pivot pin 27 to the roller hanger 38, supporting the transfer roller 14, and rod 26, and is pivotally connected at the opposite end to overcenter toggle 28 by a pivot pin indicated at 30. The overcenter toggle 28 is pivoted about a shaft 29, which in turn is secured to the press frame (not shown). A latching arm 32 is pivotally mounted to the toggle 28 and has an operating arm 31 extending upwardly therefrom for the purpose of shifting the toggle 28 and latching arm 32, carried thereby. The latching arm 32 has a recess 33 formed in the lower edge thereof which is arranged to engage with a stub shaft 34 secured to a frame portion 34a secured to the press (not shown).

A spring 35 is positioned above the rod 26 which has one end thereof engaged against a stop collar 36 which is secured to the rod 26. The other end of the spring 35 is positioned against the pivot pin 27. Rod 26 slidably extends through a hole 27a extending through the pivot pin 27. The spring 35 resiliently urges the transfer roller 14 against the form roller 6, thereby urging the ink form roller 6 into contact with the plate 20 on cylinder A. It will be seen that when the operating handle 31 is pulled to the right, as shown in FIGURE V, rod 26 moves in hole 27a until collar 37, affixed to rod 26, engages pivot pin 27. Continued movement of rod 26 will cause the toggle 28 to pivot about the shaft 29, allowing the recess 33 to engage with the stub shaft 34 to latch same in such position. This movement pulls the transfer roller 14 away from contact with the form roller 6, and spring 41 is allowed to retract to move form roller 6 away from plate cylinder A.

The transfer roller 14 is pivotally mounted on a hanger member 38 which in turn is pivotally mounted on a shaft 39 attached to the press frame (not shown), so that as

the transfer roller 14 is pulled away from the form roller 6, it is supported by the hanger 38, which is caused to pivot about the shaft 39.

An angled, offset arm 40 is pivoted about the shaft 2a which shaft also supports the ink roller 2. The form roller 6, and the shaft 6a on which it is mounted, are rotatably mounted to the lower end of the offset arm 40. A spring 41 is attached at one end to a stub shaft 42, attached to the frame of the machine, and at the other end is attached to a stub shaft 43, secured to upper end of the arm 40. The spring 41 normally pulls to the left against the upper end of the arm 40 (as shown in FIGURES IV and V) to urge the form roller 6 away from the plate cylinder A. When the transfer roller 14 is pulled away from the form roller 6 in the manner hereinbefore described, the spring 41 contracts to pull the form roller 6 away from the plate cylinder A. When the transfer roller 14 is again urged against the roller 6 by shifting the operating arm 31 to the position shown in FIGURE IV, the form roller 6 is moved and pressed against the plate cylinder A, thereby extending the spring 41.

An upward extension 44 is provided on the offset arm 40 which is engageable with the stops 45 and 46, attached to the machine frame, for the purpose of limiting the pivotal movement of the arm 40 in both directions.

A stop 47 is also secured to the machine frame which is engageable with the toggle 28 to limit the downward movement of the toggle 28 and therefore the inward movement of the transfer roller 14.

Another feature worthy of note is that, as shown in FIGURE VI, the transfer roller 14 is impressed into the resilient sponge covering material which extends around the rounded edge 48 at the ends of transfer roller 14. This prevents ink from being transferred to the end faces of transfer roller 14 when it is urged into contact with form roller 6 because less body surface on roller 14 makes contact with ink on surface of form roller 6 than is wetted by sponge covering material 13 on roller 12. Therefore, ink is prevented from accumulating on the ends of transfer roller 14, which might be fed back into the dampening system.

In FIGURES VII and VIII is shown a modified form of device for practicing the method herein described and claimed, wherein the ductor roller 10 and the sponge covered roller 12 are eliminated. The pan roller 7 and transfer roller 14 are rotated in direct contact, and dampening fluid is transferred directly from the pan roller 7 to the transfer roller 14 in the manner hereinafter explained.

As shown in FIGURES VII and VIII, the dampening fluid pan 8, dampening fluid pan roller 7 and transfer roller 14 are mounted on shifting frames 50, of which there may be one at each end of the press, said rollers 7 and 14 being rotatively mounted between the shifting frames 50.

Transverse slots 51 are provided through the shifting frames 50, and there is slidably disposed in said slots pins 52, which serve as guides and supports for said frames. Said guide pins 52 are attached to the press frame (not shown).

A spring 53 is attached between a mounting lug 54, carried by each shifting frame 50, and a stub shaft 55, attached to the frame of the lithographic printing machine. The spring 53 is extended when the shifting frames 50 are in inward position, as shown in FIGURE VII, and are arranged to move the frames 50 outwardly away from the form roller 6 when the throw arm 60 and roller 61 are rotated clockwise in the manner herein-after described.

A stop 56 is engageable with the extension 57 carried by the frame 50, to limit the outward movement of the frames 50 when the handle 58 is rotated to arcuately move the idler roller 61 upwardly to permit the frame 50 to shift outwardly with reference to the roller 6.

The throw arm 60 is secured to a shaft 59. There

may be one such throw arm 60 at each end of the machine, having a roller 61 thereon engageable with the shifting frames 50. An operating handle 58 is secured to the shaft 59, so that by moving the handle laterally the throw arm 60 and roller 61, carried thereby, may be moved arcuately as shown in broken lines in FIGURE VII.

An upper stop 62, carried by the press frame, is arranged to engage the idler roller 61 to limit the upward arcuate movement of arm 60, and a lower stop 63 is arranged to limit the downward movement of the arm 60.

An arm 64 is attached between the shaft 2a of roller 2 and shaft 6a of form roller 6, said arm 64 being pivotally attached with relation to the shaft 2a, so that when the transfer roller 14 is shifted to the right by the shifting of the end frames 50, as shown in FIGURE VIII, the spring 65, which is extended as shown in FIGURE VII, may retract, and pull the form roller 6 away from the plate 20, as the press is shifted to non-impression position. The spring 65 is attached between a stub shaft 67, carried by the arm 64, and a stub shaft 66 attached to the frame of the printing machine. Stops 68 and 69 are arranged to contact the shaft 6a, thereby limiting the lateral movement of the roller 6 in two directions.

It will be seen that by movement of the handle 58 to the left as shown in FIGURE VIII, the throw arm 60 describes a counterclockwise arcuate movement, which moves the end frames 50 to the left and toward the plate 20, as the slots 51 slide along the pins 52. Such movement continues until the transfer roller 14 contacts the form roller 6, and pushes form roller 6 into contact with the plate 20. Contact with the plate 20 is limited by the adjustable stop 68. The parts are then in the position shown in FIGURE VII.

As such movement occurs the springs 53 and 65 are extended, and upon movement of the handle 58 and the throw arm 60 in the opposite direction, the springs 53 will relax and move the end frames 50 to the right, and the spring 65 will relax and move the form roller 6 to the right, until the shaft 6a or form roller 6 contacts the stop 69. At the same time the press may or may not be moved to non-impression position. As shown in FIGURE VIII the press is in non-impression position.

It will be noted in FIGURE VIII that the dampening fluid pan roller 7 is in rotative contact with the transfer roller 14, so that a film of dampening fluid may be maintained on the surface of the transfer roller 15 while the press is in non-impression position, and so that when the press is again shifted into impression position there is no waiting period for the transfer roller 14 to be wetted, and there is no danger that ink or images may be transferred back to the transfer roller 14 when the press is shifted to impression position.

In the modified form shown in FIGURES VII and VIII, the dampening fluid pan roller 7 is rotated by an electric motor 72 through a drive chain, or belt, 70 which extends about a pulley or sprocket 71, driven by the motor 72, and about a pulley or sprocket (not shown) attached to the shaft 7a of pan roller 7.

It is desirable that the speed of rotation of the roller 7 be variable so as to regulate the amount of dampening fluid picked up thereby and transferred to the transfer roller 14, and so that the surface speed of the transfer roller 14, which is geared thereto, may be varied. For this purpose a variable rheostat 75 is provided which is mounted upon a control panel 74, and the electric current supplied thereto is controlled by an on-off switch 73. An indicator 75a is provided on the rheostat 75 and indicator graduations are preferably provided thereon to indicate the desired speed of the motor. The variable rheostat 75 is connected in series with motor 72 and thus may be employed to vary the speed of the motor 72. The transfer roller 14 is driven by connecting gears through rotation of the roller 7, and thereby the speed of rotation of the roller 14 is also controlled by the rheo-

stat 75. It is important that the speed of rotation of transfer roller 14 be controlled and variable. It could be driven by other means than that disclosed, that disclosed being merely illustrative of a suitable means.

Preferably, in the form shown in FIGURES VII and VIII, and in FIGURES X and XI, hereinafter described, the roller 7 has a resilient, smooth surface thereon so as to evenly distribute the dampening fluid applied to the transfer roller 14, in view of the fact that there are no distributing rollers therebetween.

In FIGURES X and XI is shown another modified form of dampening device to carry out the method herein described and claimed, wherein the construction is essentially the same as that described in FIGURES VII and VIII with the exception that a separate roller 91, which is not a form roller on the press, is provided which is rotatably mounted on a shaft 92, which in turn is mounted between spaced pivot arms 86 carried by the press frame. The pivot arms 86 are pivotally mounted on a shaft 87. The upper ends of the pivot arms 86 have stub shafts 90 attached to the upper ends thereof and springs 88 are attached between stub shafts 89 secured to the press frame and shafts 90. Stops 93 and 69 limit the lateral movement toward and away from the plate cylinder A of the shaft 92 on which the roller 91 is mounted.

When the shifting frames 50 are moved to the left, as shown in FIGURE X, the transfer roller 14 engages the applicator roller 91 and pushes it toward the plate cylinder A into engagement with plate 20 as the arms 86 pivot about the shaft 87. The spring 88 is expanded so that when plates 50 are shifted to the right the spring relaxes and pulls the arm 86 and roller 91, carried thereby, away from the plate.

In both forms of the device shown in FIGURES VII, VIII and X-XI, a pressure adjusting screw 94 is provided to regulate the pressure between the water pan roller 7 and the transfer roller 14, the purpose of which is hereinafter described.

For the purpose of graphically illustrating the novel function and results of the process and mechanism herein illustrated and described, an enlarged, exaggerated, diagrammatic view of the water pan roller, transfer roller, and form or other applicator roller is shown in FIGURE IX.

As shown in such exaggerated illustration, the dampening fluid pan roller 7, which is preferably a resilient roller having a smooth surface thereon, has the lower side thereof immersed in the dampening fluid 9 in the pan or container 8. The roller 7 is in rotative contact with the fluid transfer roller 14, and the pressure is adjusted therebetween by the adjustment screw 94, so that the surface of the transfer roller 14 is actually impressed into the surface of the roller 7 as indicated at 81. Such pressure at the tangent point between the rollers 7 and 14 may be adjusted by the adjustment screw 94, but once adjusted, it normally does not need to be re-adjusted during the operation of the press.

As the roller 7 rotates toward the point of tangency between the rollers 7 and 14, a relatively heavy layer of dampening fluid, indicated at 79, is picked up and lifted on the surface of the roller 7, and at the point of tangency, or cusp area 100, between the rollers 7 and 14, a bead 80 of dampening fluid is piled up, the greatness of which is regulated by virtue of the fact that excess water will fall back into the pan 8 by gravity, thus virtually creating a water fall. The bead 80 becomes a reservoir from which dampening fluid is drawn by transfer roller 14. As the rollers 7 and 14 rotate in contact, a relatively thin layer of dampening fluid is metered between the contact surfaces of the two rollers, as indicated at 81. Since the transfer roller 14 is treated to provide a smooth, hydrophilic surface thereon, a portion of the film 81 adheres to the surface of the roller 14 as indicated at 82, the remaining portion 83 thereof being rotated back to the fluid 9 in the pan 8. The film of dampening fluid 82 is evenly distributed on the surface

of the roller 14 by reason of the rotating, squeezing action between the rollers 7 and 14 at their tangent point.

The film of dampening fluid 92 rides on the surface of the roller 14 and comes in contact with the film of viscous ink 78 on the form roller 6 at the tangent point between said rollers, as indicated at 95.

At such tangent point 95 it will be observed that the transfer roller 14 is impressed into the resilient surface of form roller 6 and that the film of dampening fluid 82 has an outer face 96, contacting ink film 78, and an inner face 97 adhering to the surface of roller 14 and actually separates the surface of the roller 14 from the film of ink 78 on the roller 6, so that there is in fact a hydraulic connection between the rollers 6 and 14 as they rotate in close relationship, but there is no physical contact therebetween. The film of ink 78 is actually separated from the smooth surface of the roller 14 by the film of dampening fluid 82.

It is an important fact to note that the film of dampening fluid 82 permits the rollers 6 and 14 to be rotated at different surface speeds as will be hereinafter explained. Preferably the applicator roller 6, which is normally rotated at the same surface speed as the plate 20, is rotated at a greater surface speed than the surface speed of the roller 14. However, it will be understood that the roller 14 could be rotated at a greater surface speed than the roller 6 and accomplish the same functions and results as hereinafter related. By regulating the differential surface speeds between rollers 6 and 14 the amount of dampening fluid applied to the plate 20 may be regulated. In other words if the speed of roller 14 is increased the dampening fluid film 82 is presented at the tangent point 95 at a faster rate and more dampening fluid is transferred on the surface of ink film 78 to plate 20, and the opposite is true if the speed of roller 14 is decreased.

The film of dampening fluid 82, existent between the contacting surfaces of the rollers 6 and 14, permits the rollers 6 and 14 to be rotated at different surface speeds in sliding relationship, because the film of dampening fluid 82 actually constitutes a lubricant which permits slippage between the contacting surfaces of the rollers 6 and 14 without frictional deterioration. By reason of the slippage between the rollers 6 and 14, the dampening fluid film 82 is calendared, smoothed out, metered and distributed between the contacting surfaces of the rollers 6 and 14, and the thickness and amount thereof is actually regulated by such means.

The speed of rotation of the roller 14 may be regulated by the speed of rotation of the water pan roller 7 through the variable speed control 75, or it may be controlled otherwise, so that by increasing or decreasing the speed of rotation of the roller 14 the amount of the water film applied between the contacting surfaces of the rollers 6 and 14 may be regulated by virtue of the change in relative surface speed and rate of slippage therebetween. By regulating the pressure between the rollers 7 and 14 with the pressure regulator screw 94, the thickness of the film of dampening fluid 82 may also be regulated to some extent.

It will be noted that by reason of the positive drive between the motor 72 and the pan roller 7 the tendency of overdrive to the roller 14 from the form roller 6 is prevented. In other words in the event that the rotation of the plate cylinder A, which is in engagement with the form roller 6, is speeded up, the relative rotative movement imparted to the roller 6 cannot be imparted to the transfer roller 14 because of the positive drive between rollers 7 and 14. Therefore, the transfer roller 14 may be rotated at a predetermined speed to supply the desired amount of dampening fluid to the plate for the particular job, but the speed may be regulated and controlled as required. It will be understood that the roller 14 may be positively driven by drive means attached directly thereto and the speed controlled, as desired.

Therefore, it will be seen that by reason of the damp-

ening fluid film separation between the tangent point of the form roller 6 and the transfer roller 14, slippage is permitted between the contacting surfaces of such rollers which provides a metering effect to control the amount and thickness of moisture film applied to the plate.

As the rollers 6 and 14 rotate away from their tangent point, as indicated at 98, the film of dampening fluid 82 is caused to split, one film 84 adheres to the surface of the more viscous ink film 78 on roller 6, and the other part of the less viscous film 85 adheres to the surface of the transfer roller 14 from whence it is conveyed back to the water pile 80.

It has already been explained that the dampening fluid film 82 is smoothed out, distributed, metered, and regulated between the tangent points of the rollers 6 and 14. The interfacial tension between the outer surface 96 of the less viscous dampening fluid film 82, by reason of molecular attraction between the surface of the more viscous ink film 78, causes the smoothed and regulated film 84 to cling to the surface of the ink 78, which in turn is transferred directly to the plate at the tangent point between the plate and the form roller 6, as indicated at 99. The less viscous dampening fluid adheres to and travels upon the surface of the more viscous ink film 78. The more viscous ink film will not separate and cling to the less viscous dampening fluid film. Therefore ink is not fed back into the dampening system.

No appreciable amount of the dampening fluid passes the tangent point 99, but such as does is transferred on the ink film 78 to the ink film 77 about the ink vibrator roller 2 where it is dissipated and absorbed, to such an extent as to be of no consequence in the inking system.

It will be noted that by reason of the regulated and evenly distributed film 82 on the transfer roller 14 and the very thin regulated film 97 resulting from the slippage between the tangent points of the rollers 6 and 14, there is no feed back of ink from the film 78 to the surface of the roller 14, because such ink surface is actually separated from the roller 14 by a film of dampening fluid.

However, in the event that any minute amount of ink should be transferred back to the transfer roller 14, or in the event printing patterns should be transferred thereto by the ink film 78 rotatively contacted with the plate, such will be completely rubbed out and obliterated by the slippage between the rollers 6 and 14 and will be absorbed and dissipated in the accumulation bead 80 and the water fall 79, so that it is not transferred about the surface of the roller 14 to cause a cumulative effect between the tangent points of the rollers 6 and 14.

As has been explained hereinbefore, and as is well known in the art, the regulation of the amount of dampening fluid transferred to the plate is a critical matter in the lithographic printing process. Other forms of dampening devices have, as a rule, transferred too much dampening fluid to the plate, causing the undesirable effects hereinbefore explained. By the use of the process and apparatus herein described, the amount of dampening fluid can be very accurately and minutely regulated to the exact amount required for the particular application, resulting in the lack of accumulation of droplets of dampening fluid on the plate, the excessive application of dampening fluid to the paper stock, the undesirable effects of too much dampening fluid applied to the printed surface, and generally results in a printing job of superior and unsurpassed quality.

Although it is convenient to employ the form roller 6 as a transfer roller between the roller 14 and the plate 20, it will be understood that such transfer roller need not be a form roller presently existent on lithographic offset printing presses. It can be a separate roller, such as roller 91, previously described, which may have a surface treated to receive a greasy film such as ink, or otherwise formed and treated to provide a receiving surface for the dampening fluid film 84 as the transfer roller 14 rolls in contact therewith. The roller 91 could be a con-

ventional fabric covered roller to which moistening fluid is transferred in the manner hereinbefore described, and therefrom to the plate 20.

Of course, in the modified forms shown in FIGURES VII and VIII and X-XI, the same type of dampening fluid as hereinbefore described may be employed, and the roller 14 is of the same type and has a smooth, polished, hydrophilic surface thereon, treated in the manner hereinbefore described.

It will be noted that there is an uninterrupted film of moistening fluid exposed to the surface of the ink film on the form roller 6 by reason of the scrubbing and slipping action between the rollers 14 and 6, or rollers 14 and 91, so that there is lateral distribution and an evenly distributed, unbroken, uninterrupted film of dampening fluid between the surfaces of the rollers 6 and 14 at all times, which prevents the feed back of ink into the dampening system.

It will further be noted that the vertical relationship between the axis of the rollers 7 and 14 are such that gravity is employed to cause excess water to flow back into the water pan 8 and provides an area in the cusp between the rollers adjacent to the water fall portion 79 which allows accumulation of a bead 80 to perform the novel functions hereinbefore described. In other words, the cusp 100 is recessed adjacent the tangent point between the rollers 7 and 14 along a substantially horizontal line so that the cusp 100 actually provides a pocket for receiving and maintaining the bead 80 to thereby provide a constant reservoir of dampening fluid from which the film of fluid 82 may be picked up. There is continuous rolling contact between rollers 7 and 14, which permits accumulation and continuous maintenance of reservoir bead 80. This could not occur in a conventional dampening system, employing a reciprocating ductor roller, which is not in continuous contact with the transfer roller and water pan roller. Such continuous rolling contact between pan roller 7 and transfer roller 14 is important because it assures that a constant source of dampening fluid supply is provided at the tangent point between rollers 7 and 14 to provide continuous and evenly distributed film 82 on roller 14.

By applying dampening fluid to the surface of the ink film 78, there results an automatic lateral control in quantity in that the ink, when it reaches its dampening fluid absorptive capacity, resists application of further dampening fluid. Therefore, only a regulated film of dampening fluid is transferred to the plate. This was not true with previous fabric covered dampener rollers which were saturated with dampening fluid and rolled in direct contact with the plate, causing accumulation of excess dampening fluid on the plate.

FIGURE XII shows the preferred relationship between the ends of rollers 6 and 14 or 91 and 14 in the modified forms of FIGURES VII and VIII and IX and X. It has been found that dampening fluid accumulates in a relatively thick band, shown in exaggerated form at 102, at the ends of transfer roller 14. To prevent this excessive accumulation from being transferred to the applicator roller, the transfer roller is caused to extend beyond the ends of applicator roller 6 (or 91) as indicated at 101.

FIGURES XIII-XVI illustrate uses for the specially finished hydrophilic roller 14, heretofore described, other than in dampeners for lithographic offset printing presses.

In FIGURE XIII there are shown two of such hydrophilic rollers 14 employed in a device for calendaring and cooling the surface of material such as a viscous material or coating material, such as plastic, wax, etc. to compress, smooth and cool same. One of the rollers 14 rotates in the dampening fluid 105 in a pan 106, and picks up and transfers a film 107 of dampening fluid which is metered between the pan roller and a resilient, smooth surfaced roller 108. The other roller 14 is a calendaring roller one side of which runs in metering contact with the resilient metering roller 108. The other side of calendaring roller

14 runs in pressure contact with the surface of a sheet of material 109 to smooth, cool and calendar same. The material 109 is supported and backed up by a steel web 110 which may be backed up by a rotatable metal roller 111. The thickness of the film of metered dampening fluid 107 may be regulated by varying the pressure relationship between rollers 14 and resilient roller 108. The speed of rotation of calendaring roller 14 may be varied to cause the surface thereof to move at a different speed than the surface of the material 109 to allow slippage therebetween. The dampening fluid 107 provides lubrication between the adjacent surfaces, and the slippage therebetween permits superior calendaring action and at the same time the dampening fluid cools the material 109. This is particularly desirable where the material 109 is plastic, wax or like material which must be cooled to set same and may be smoothed and calendared simultaneously with setting.

In FIGURE XIV the hydrophilic, specially treated and finished pan roller 14 runs in the dampening fluid 112 in pan 113. Resilient, smooth surfaced metering roller 114 rolls in pressure metering relationship with pan roller 14 and specially treated and finished dampening roller 14 which in turn rolls in contact with sheet material 115. Material 115 may be paper, cloth, plastic film, or the like which it is desired to dampen with dye, wax, or the like. The fluid may be dampening fluid, dye, wax or other material which may be metered into a uniform film 116 between rollers 14 and 114, which may be adjusted in pressure relationship, and the relative surface speeds between the rollers may be regulated as hereinbefore explained.

In FIGURE XV the specially treated and finished hydrophilic roller 14 rotates in a fluid coating material 117 in pan 118. The thickness of the coating material 117 may be regulated by a doctor blade 119 which may be applied to the surface of a web which is run in surface pressure relationship with roller 14 to apply a coating 121 thereto.

In FIGURE XVI a resilient, smooth surfaced metering roller 122 rotates in fluid coating material 123 in pan 124. Specially treated hydrophilic roller 14 rolls in surface pressure relationship with resilient roller 122 to meter a film of coating material therebetween. A web of material 126 to be coated is run in pressure contact between roller 14 and a resilient smooth surfaced back up roller 127 to apply a coating of material 128 to the surface of web 126. The surface pressure relationship between rollers 14, 122, 127 may be varied and the relative speeds of rotation may be varied. The coating material 125 may thus be varied in thickness and smoothed out as it is uniformly applied to the surface of web 126.

In FIGURE XVII two specially treated hydrophilic rollers 14 are employed to polish both sides of a web of material. The rollers 14 may rotate at a different surface speed than web 129 to polish the surface thereof. The smooth polished surface of rollers 14 permits this difference in surface speeds with minimum friction damage. If desired resilient metering rollers, such as 7, could be rotated in surface pressure relationship with polishing rollers 14 and apply a metered film of dampening fluid to the surface of web 129 to virtually alleviate frictional heat and damage.

With reference to the foregoing it may be summarized that there has been provided a dampening system wherein there is a complete interfacial system for transferring dampening fluid to the applicator roller and subsequently to the plate, without any physical connection between the dampening fluid source and the plate, but wherein the respective rollers for transferring the dampening fluid to the surface of the plate, are actually hydraulically separated by the film of dampening fluid which is perfectly spread and distributed laterally by slippage action between the respective rollers, which not only gives perfect distribution and an even film of dampening, coating or other fluid, but provides for an accurate control of the amount thereof, thereby assuring that the non-printing

areas of the plate will be properly dampened with exactly the correct amount of dampening or other fluid, but not an excess amount thereof.

In the practice of such process the dampening fluid performs a triple function, in that it provides (1) for dampening of the plate, (2) it provides a lubricating medium between the surfaces of the transfer rollers so that they can be rotated at different surface speeds to cause slippage therebetween without frictional damage or deterioration, thereby providing for even distribution, accurate quantity application, and control thereof, and (3) it serves to effect a hydraulic separation between the dampening fluid applicator roller and the dampening fluid supply means.

It will be seen that I have provided a process and mechanism for supplying dampening fluid to the plate on an offset printing machine which supplies uniformly distributed and regulated amounts of moisture to the plate without contact with the plate by dampening rollers, which lessens or entirely eliminates the use of water as a dampening fluid with the resultant disadvantages thereof, and provides a dampening process which eliminates the necessity of constant adjustments of dampening fluid supplied to the plate, and which is virtually automatic in the regulation of the amount of dampening fluid supplied. It permits the use of cheaper and more ink receptive paper and provides better quality lithographic offset printing. There has also been provided a specially treated and finished transfer roller which can be employed for dampening, calendaring, cooling, coating and polishing surfaces and materials.

It will be apparent that other and further forms of the invention may be devised without departing from the spirit and scope of the appended claims, such as dripping, spraying, wiping or otherwise, applying dampening fluid to the transfer roller 14.

Having described my invention I claim:

1. A process for dampening the plate on a lithographic press comprising the steps of: Providing a transfer roller having a continuous, uninterrupted, hard, polished, hydrophilic surface thereon; applying a film of a water soluble, volatile organic, ink receptive dampening fluid to the surface of the transfer roller as it rotates; rotating the film of dampening fluid in contact with an ink coating on the surface of a cylindrical member to divide the film of dampening fluid and deposit a portion thereof on the surface of the ink coating; rotating the cylindrical member in contact with a lithographic printing plate; the cylindrical member and transfer roller being rotated at

different surface speeds to cause slippage therebetween at their tangent point.

2. The process called for in claim 1 wherein the dampening fluid is comprised of a mixture of water soluble, volatile, organic liquid and water.

3. The process called for in claim 2 wherein the water soluble organic liquid is methyl alcohol.

4. The process called for in claim 2 wherein the water soluble volatile organic liquid is ethyl alcohol.

5. The process called for in claim 2 wherein the water soluble, volatile, organic liquid is isopropyl alcohol.

6. In a process for dampening the plate on a lithographic press, the provision of a dampening fluid transfer roller having a continuous, uninterrupted, hard smoothly finished hydrophilic surface thereon; the provision of a resilient ink coated applicator roller in rotative contact with the plate and with the surface of the transfer roller; the provision of a dampening fluid metering roller having a smooth resilient surface thereon in rotative contact with the surface of the transfer roller and adapted to be indented in metering relationship with the transfer roller; applying a water soluble, volatile, ink receptive dampening fluid to the surfaces of the resilient metering roller and the transfer roller as their surfaces approach contacting relationship; adjusting the pressure relationship between the resilient metering and the transfer roller; adjusting the surface pressure relationship between the applicator roller and the transfer roller; rotating the contacting surfaces of the transfer roller and applicator roller in the same direction at different surface speeds; and varying the relative speed of rotation between the applicator roller and the transfer roller.

References Cited by the Examiner

UNITED STATES PATENTS

2,238,050	4/1941	Goedike	101—148
2,278,982	4/1942	Frolich	91—67.8
2,333,800	11/1943	Lewis et al.	91—67.8
2,430,965	11/1947	Taylor	101—350
3,094,065	6/1963	Roberts	101—148

OTHER REFERENCES

Martinson: The Use of Low Molecular Weight Alcohols in Lithographic Fountain Solutions, Modern Lithography, page 51, August 1952, NE 2250.M6.

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