Feb. 7, 1956 W. G. MULLEN 2,733,653

DAMPENING SYSTEM AND METHOD OF USING SAME

Filed Jan. 14, 1953

Fig. 1

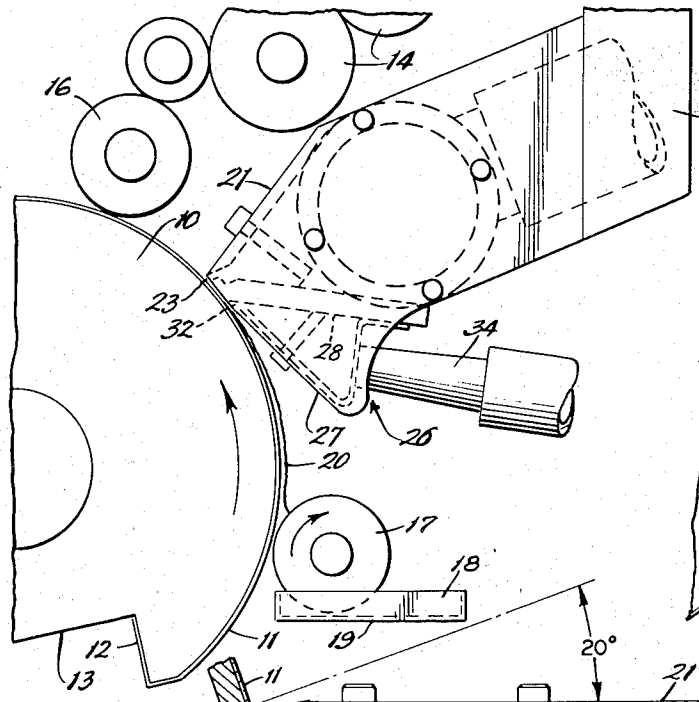


Fig. 4

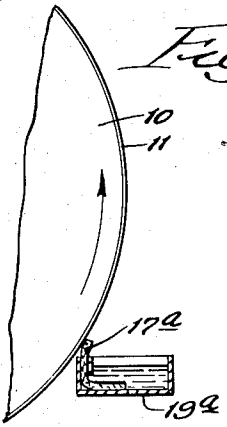


Fig. 2

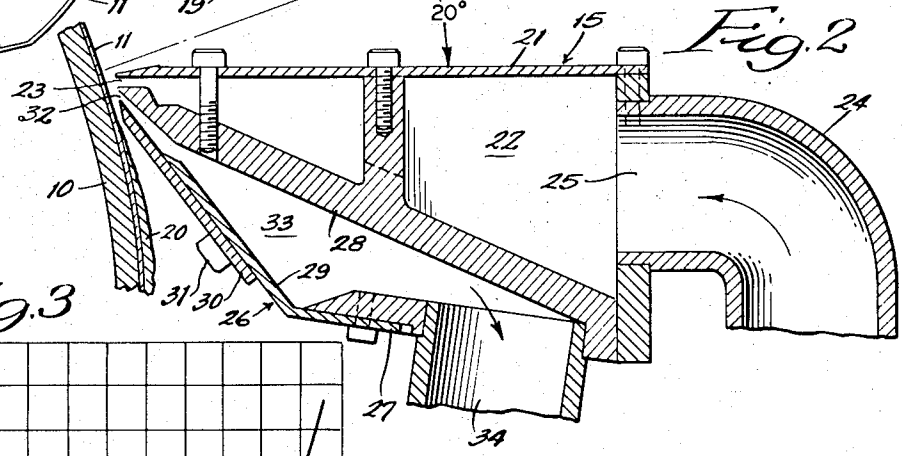
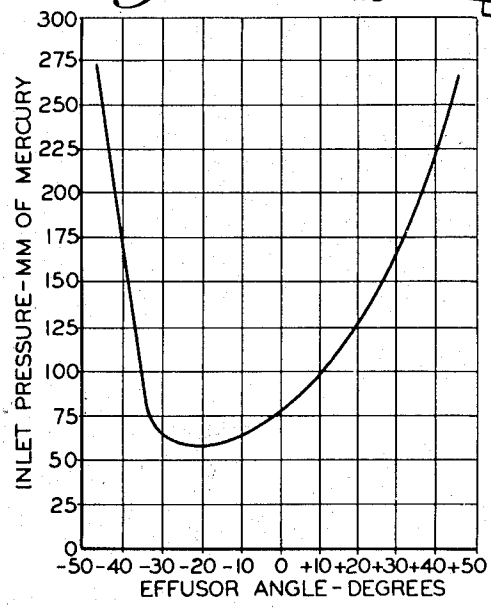


Fig. 3



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DAMPENING SYSTEM AND METHOD OF USING SAME

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8 Claims. (Cl. 101—147)

This invention relates to an improvement in the application of repellent to the surface of a lithographic printing plate and it relates more particularly to apparatus used in connection with a lithographic printing press for the application of repellent to the plate surface.

The principles underlying the operation of a lithographic plate are well recognized and the same whether the plate be formed of the old lithographic stone etched metal plate or the more recently developed coated paper lithographic plates. In theory, the imaged portion of the plate becomes ink receptive and water repellent while the non-imaged portion forming the remainder of the plate surface is hydrophilic in character and preferentially receives water and repels the oily or greasy ink compositions.

In operation, an aqueous repellent is first applied to wet the surface of the plate. When present in the desired amounts, the repellent wets only the hydrophilic, non-imaged portion so that greasy inks will be repelled thereby and received only by the imaged portion for transfer onto the offset blanket for the production of copy. It is generally recognized by those skilled in the art that the critical conditions in the operation of a lithographic plate in planographic printing resides in the maintenance of a desired balance of repellent on the plate surface. Much of this difficulty stems from uncontrolled factors characteristic of present dampening systems. When too much repellent is present on the surface of the plate, the imaged portion becomes wetted, in part, and the copy "grays," while insufficient repellent on the surface of the plate causes the entire surface of the plate to take ink, whereby the image becomes "blacked out" and copy of acceptable quality is incapable of being produced.

It is believed that the basic difficulty which prevents any possibility of maintaining the desired balance of control in present systems is due in part to the fact that when the plate dampeners are wet sufficiently to prevent any transfer of ink from the plate image, they, at the same time, are too wet to print properly. As a result, it has been necessary to strike a compromise. In practice, the form roller is wet sufficient to prevent scumming but not enough to repel the ink entirely. As a result, the dampening form roller becomes progressively contaminated with ink and requires increasing amounts of repellent to prevent scumming on the plate.

In addition to the above, the present dampening system is subject to a number of other objections, a few of which will hereinafter be specifically mentioned. (1) Because of the requirement for having the dampening rollers properly wet out with repellent before contact with the surface of the plate, it is impossible to start operation to produce copy until several cycles have been made properly to condition the dampening roller. (2) It is necessary to maintain an accurate adjustment between the dampener and the plate surface for application of sufficient repellent without excessive contamination of the form roller or damage to the image on the plate surface.

(3) In effect, the control through the dampening system is limited to one direction only. While additional water can be applied when necessary, no means is available for cutting back on the amount of moisture on the plate surface other than to dissipate the excess in use gradually by cutting down on the supply until the desired conditions are temporarily secured. In the meantime copy of poor quality is being produced. (4) The presence of the dampening roller in contact with the lithographic surface constitutes a source of wear and damage to the image and can materially affect the number of copies which can be produced. (5) Because of the contamination factor and the removal of ink by the molleton or dampening rollers operating in contact with the surface of the plate, the molleton covers must be replaced or cleaned periodically and additional press operations are required to break the dampeners in for proper use.

The objectionable features of present dampening systems which make use of a molleton roller or other dampening form roller have been substantially completely eliminated by the new and improved dampening system of the type described and claimed in the Mullen Patent No. 2,604,848, which issued on July 29, 1952. Briefly described, the Mullen system makes use of a water roll which applies an excess of water onto the surface of the plate in advance of the inking form roller. The excess moisture is removed from the surface of the plate by an air blade which operates continuously across the plate and may be adjusted substantially completely to remove the water from the imaged areas of the plate while leaving a film of water of minimum thickness over the non-imaged areas. The described Mullen system provides an exact control of moisture for each revolution of the plate cylinder and independently of the amount of moisture present on the surface of the plate in the previous cycle. Thus it is possible to achieve proper wetting in the first cycle of the machine for the production of copy and it is also possible to achieve immediate adjustment in the amount of moisture on the plate surface without juggling the ratio of water to ink as the printing operation continues. Once the amount of moisture for best operation has been established, it is possible to maintain the desired conditions substantially indefinitely during the operation of the machine. By reason of the fact that the moistening roll applies an excess of water without contact with the surface of the plate, wear on the plate is eliminated as a factor and no ink is capable of being transferred back from the surface of the plate thereby to eliminate the problems incident to the transfer of ink to the dampening roller as in the present systems. Because the air blade removes all entangling water from the dot image and establishes essentially a dry dot image, this system is better adapted to the reproduction of sharper as well as full inked dots in tone and half-tone printing.

The dampening system of the type described differs basically from the present systems in that it is not dependent upon the amount of water repellent applied to the surface of the plate but relies upon the application of a controllable excess of repellent to the plate and the reduction of the excess water film by adjustment of air pressure to provide a minimum quantity on the non-printing areas and substantially complete absence of moisture on inked areas at the point of contact between the plate and the ink form rollers.

While the described air blade system for plate dampening provides a vast improvement in the operation of a planographic printing machine, it is an object of this invention to provide still further improvements in the dampening system of the type described.

It is an object of this invention to provide a dampening system of the type described in which problems incident

to the removal of excess moisture cut from the surface of the plate is substantially eliminated; in which a more uniform and controlled film of repellent is permitted to remain upon the plate surface when brought in contact with the inking form rollers; in which the amount of air capable of being entrapped in the water layer is reduced to a minimum thereby to provide for a more controlled film of moisture.

These and other objects and advantages of this system will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing in which—

Figure 1 is a schematic elevational view of a portion of a planographic printing press embodying features of this invention;

Figure 2 is an enlarged sectional elevational view of the mechanism for removing excess moisture from the surface of the plate;

Figure 3 is a chart comparing the efficiency of the effusor at various angles, and

Figure 4 is a fragmentary elevational view showing a modification in a repellent applicator means.

In accordance with practice of this invention, the operation of a dampening system of the type described has been found to be greatly improved by the use of an air blade or effusor set to operate upon the surface of the plate at a negative angle with respect to the radius of the plate cylinder at the line of contact between the air blade and the plate and in the use of a vacuum means to dispose of the excess repellent rolled back by the air blade operating to remove the excess moisture from the surface of the plate. Optimum conditions have been found to result when the angle of the knife blade ranges from −10° to −30° with the normal at a point of engagement but improvements are still secured when the air blade is set at less than zero but greater than −3° from normal.

When the use of a negative angle within the range described, negative pressures following the Bernuli principle are found to exist in the area of the "slick" and that the "slick" is shortened to the extent that the "wake" moves up to permit positioning of the vacuum removal means closer to the blade thereby to minimize the difficulties relating to the removal of the excess moisture a the tail end of the plate. In the event that the distance between the air blade or effusor and the wake were large, it would be difficult to achieve proper moisture control in the end portion of the plate.

When a plus angle is used, the air issuing from the effusor divides in favor of flowing back and the excess moisture cut from the surface of the plate becomes turbulent with a resulting loss in control and with the introduction of excessive amounts of air bubbles with the consequent non-unformity in the moisture layer which remains on the plate. When turbulence occurs and air in excessive amounts is entrained within the repellent, it then becomes necessary to make use of special equipment to separate the air from the repellent for subsequent recirculation in the dampening system. With a plus angle, the vacuum means adapted for removal of the excess moisture rolled back upon the surface of the plate would of necessity be located far back on the cylinder with the result that the air would interfere with the operational characteristics of the plate.

For purposes of illustrating the improvement described and claimed herein, reference will now be made to the accompanying schematic drawing in which **10** indicates the plate cylinder of a conventional printing press used for direct or offset printing.

The plate cylinder **10** is adapted to support the usual imaged lithographic plate **11** which is secured at its leading edge and at its trailing edge **12** within a depression **13** formed to extend across a portion of the plate cylinder. Ink distributing rolls **14** of the conventional type function to transfer ink from a fountain **15** to an ink form roller **16** which engages the surface of the plate **11** for transfer of ink to the imaged portion in the production of copy.

The improvement embodying the concepts of this invention relates to the means in advance of the inking system for the application of repellent and control of the amount which remains on the surface of the plate to repel transfer of ink to the non-imaged areas without interfering with the transfer of ink to the imaged areas whereby copy of good quality can be secured repeatedly with minimum wear on the imaged plate and without contamination of the elements functioning in cooperation therewith.

A repellent roller **17** rotating out of contact with the peripheral surface of the plate **11**, but spaced a very short distance therefrom, is partially immersed in a bath **18** of repellent contained in a suitable trough **19**. The roller may be rotated in the same direction but is preferably rotated opposite that of the plate cylinder so that a film of water or repellent **20** in excess of that required is transferred from the roller **17** onto the surface of the plate **11**. The amount of repellent applied may be varied in accordance with the distance between the surface of the plate and the repellent roller and the relationship between their linear speeds but it will be apparent that application is effected without contact between the repellent roller and the surface of the plate thereby to avoid wear or deterioration of the imaged plate and prevent transfer back of ink composition from the surface of the plate to the repellent system.

This not only provides for the production of a greater number of copies of good quality from the imaged plate but eliminates the necessity for a molleton system and the consequent difficulties of replacing molleton covers and breaking in the molleton rollers for operation. It also greatly simplifies the repellent system since the amount of repellent applied is not critical so long as an excess is present on the surface of the plate thereby to eliminate the necessity for taking special precautions to control and distribute the repellent on the form or molleton rollers, as in present systems. While the use of a repellent roller out of contact with the surface of the plate is preferred, excess repellent can be applied onto the surface of the plate by other means such as a spray gun or shower-head or by a wick **17a** for transmitting repellent from a bath **18a** in a container **19a** to the surface of the plate.

The excess repellent is rolled back onto the surface of the plate by an air knife **21** which directs a continuous plane of air onto the surface of the plate **11** along a line between the repellent applicating roler **17** and the ink form roller **16**.

The air knife, which is rigidly mounted adjacent the surface of the plate cylinder, has an air chamber **22** which terminates at its forward end into an elongate slot **23** shaped to make most efficient use of the air passing therebetween under pressure to cut repellent from the surface of the plate in amounts which depend upon the air pressure and the distance between the slot and the surface of the plate. It has been found that conditions which require minimum air pressure provide for best operation, as will hereinafter be more specifically defined. For most efficient utilization of the air, it appears best to provide an outlet opening in the form of a slot **23** of substantially uniform dimension for a distance sufficient to channel the air stream and minimize spread or divergence upon issuing from the slot. Air under pressure is admitted into the chamber **22** through a conduit **24** which communicates a source of air under high pressure with the air chamber through an inlet opening **25** in the rear of the housing.

A new and novel concept of this invention resides in the use of vacuum means **26** for constantly removing repellent rolled back upon the surface of the plate by the air knife or effuser thereby to eliminate problems

arising from the build-up of repellent behind the knife and the disposition of the repellent at the tail end of the plate. The vacuum removal means is adapted to function continuously across the plate to remove repellent preferably at the point where the "wake" is formed. Illustration is made of one form of vacuum means which may be used but it will be understood that other constructions adapted to provide similar results may be employed.

In the illustration, there is provided an elongate housing 27 having an upper wall 28 and a downwardly inclined lower wall 29 having a slide plate 30 secured by nut means 31 to the underside of the bottom wall 29 for shifting movement in the direction toward and away from the plate cylinder thereby to vary the spaced relation between the vacuum inlet 32 and the surface of the plate and also to vary the width of the slot 32 through which the repellent is drawn from the surface of the plate. The air plenum chamber 33 defined by the converging walls 28 and 29 communicates with a means for withdrawing air in large volumes through passage 34. The lower wall 29 of the housing is downwardly inclined to permit repellent withdrawn from the plate to drain into means associated with the described extractor for separating the air from repellent to enable recirculation of the repellent for wetting the surface of the plate.

It has been found that the reduction of the air pressure required to effect removal of excess repellent from the surface of the plate passing beneath the effusor correspondingly reduces the length of the "slick" that is formed and the distance between the vacuum nozzle and the air knife thereby to permit a closer spacing between the vacuum removal means and the effusor. Reduction in air pressure also provides for less turbulence at the point of contact between the air knife and repellent on the surface of the plate and in the "wake" formed to the rear thereof with the result that less air becomes entrapped in the repellent layer and a smoother coating with complete control is secured in the amount of repellent that is permitted to remain on the surface of the plate that is advanced to the air form roller. A reduction of air pressure and vacuum of air also prevents loss of the control which might arise by evaporation of repellent from the surface of the plate after the excess has been removed by the air knife.

In the past, the air knife has been positioned to direct the blade of air back upon the surface of the plate in the direction opposite rotation or at a plus angle with the normal. When using a plus angle, substantial amounts of the air divide and flow back onto the plate and create such turbulence that an uneven and streaky film of repellent is left on the plate and the excess rolled back becomes uncontrollable and an excessive amount of air becomes entrained.

An important feature of this invention resides in the discovery that the operational characteristic of the air knife is greatly improved if, instead of positioning the knife blade at a plus angle, the knife blade operates at a negative angle of between zero and −32° with the normal and preferably within the range of 10 to −30°. Optimum conditions are secured with respect to air pressure, moisture control, reduction in turbulence, reduction of the length of the "slick," and smoothness and uniformity of the repellent layer permitted to remain as a coating on the non-imaged areas of the plate. The improvement resulting from positioning the air blade at a negative angle within the limits prescribed is graphically illustrated in the chart of Figure 3 which compares the air pressure required to secure a predetermined thickness of repellent on the surface of the plate when the air blade is positioned at various angles. It will be observed that optimum conditions exist when the air blade is positioned at a negative angle of between −20° to −25° and that a sharp break occurs when the knife blade is positioned at an angle beyond −32° to −33°, which as a result forms the lower limit of setting. These conditions prevail in general independent of the film thickness or repellent used.

When a negative angle within the limits prescribed is used, the "slick" is greatly shortened so that the "wake" forms almost immediately behind the effusor. This permits the vacuum means to be located closely adjacent the air knife and to be formed practically as a part thereof, as illustrated, thereby not only to simplify assembly and use but also to eliminate any of the problems previously described in connection with the use of an air blade set at a plus angle. It is believed that negative pressures exist immediately to the rear of the air blade when positioned at a minus angle and that such negative pressures provide for a smooth "slick" and for less turbulence in the "wake" with a consequent less entrainment of air in the repellent and more uniform control of the coating.

In securing the results recorded in the chart of Figure 3, calculations were based upon the production of a film thickness of about 0.0002 inch of moisture on the plate surface. The slot opening of the effusor or air knife was set about 0.020 inch and located at about 0.1 inch from the plate. The repellent roll was set with its surface about 0.003 inch from the surface of the plate and a film of about 0.007 inch of repellent was applied onto the surface of the plate thereby. The repellent roll was rotated at about 250 revolutions per minute and the plate cylinder at about 84 revolutions per minute. This provides for a ratio between the plate and roller of about 5 to 3.

It will be understood that various changes may be made in the construction and in the arrangement of the elements described without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A dampening system for planographic printing plates mounted for movement in one direction on a support, comprising means for applying an excess of liquid repellent over the entire surface of the plate, means closely adjacent the surface of the plate for directing a stream of air extending continuously as a blade cross wise of the plate onto the plate surface beyond the repellent applying means and at an angle with the normal from the plate which is less than zero but greater than −30° whereby repellent from the imaged portions of the plate and the excess repellent from the non-printing portions of the plate is displaced rearwardly onto the plate, and suction means having an inlet opening in parallel relation with the blade of air engaging the plate and located immediately rearwardly thereof and extending crosswise in parallel relation with the plate for removal of repellent displaced rearwardly by the blade from the surface of the plate.

2. A dampening system for a planographic printing plate mounted for rotational movement on a plate cylinder, comprising means for applying an excess of liquid repellent onto the surface of the plate and means for removing the repellent from the imaged areas of the plate and for removing the excess from the non-printing portions of the plate including an air nozzle having an outlet opening extending continuously crosswise of and in closely spaced relation with the surface of the plate and positioned to direct the stream of air issuing as a continuous blade therefrom onto the surface of the plate at an angle less than zero but greater than −30° with the normal of the plate whereby the excess of the repellent on the surface of the plate and repellent on the imaged portions thereof is displaced rearwardly onto the oncoming portions of the plate, and means for removing repellent displaced rearwardly onto the plate comprising a housing having the inlet opening aligned with the outlet of the air nozzle and closely spaced rearwardly thereof in closely spaced relation with the plate surface to remove repellent displaced rearwardly onto the surface of the plate.

3. A dampening system for a planographic printing

plate mounted for movement in one direction on a support, means for applying an excess of liquid repellent onto the surface of the plate and means for removing repellent from the imaged areas of the plate and the excess repellent from the non-printing portions of the plate including an air nozzle having an outlet opening extending continuously crosswise of and in closely spaced relation with the surface of the plate, said air nozzle being positioned to direct the stream of air as a continous air blade onto the surface of the plate at an angle of less than zero but greater than —30° with the normal to the plate whereby the excess repellent on the surface of the plate and repellent on the imaged portions thereof is displaced rearwardly onto the oncoming portions of the plate, means for removing the repellent displaced rearwardly onto the plate comprising a housing having an inlet opening aligned with the outlet opening of the air nozzzle and in closely spaced parallel relation therewith and in closely spaced relation with the plate surface to remove repellent displaced rearwardly onto the surface of the plate, means for introducing air into the air nozzzle for passage through the outlet opening as an air stream of high velocity, and means for withdrawing air from the suction housing to withdraw repellent through the inlet opening from the surface of the plate.

4. A dampening system as claimed in claim 3 which includes means for adjusting the pressure of the air introduced into the blade housing to adjust the pressure of air in the air blade extending across the surface of the plate.

5. A dampening system as claimed in claim 3 in which the air nozzle is positioned to direct the air blade onto the plate at an angle between —10° and —30°.

6. The method of dampening a planographic printing plate by the use of apparatus of the type described which comprises moving the printing plate continuously in one direction, applying a liquid repellent onto the surface of the plate in excess of the amount required for use in the printing operation, directing a stream of air which extends continuously crosswise of the plate as a blade onto the surface of the plate at an angle less than zero but greater than —30° with the normal to the plate whereby the excess repellent on the non-printing portions of the plate and repellent on the imaged portions is displaced rearwardly onto the plate from the line of contact between the air blade and the plate and removing repellent displaced rearwardly onto the plate by suction means having its inlet opening aligned with the blade and positioned immediately rearwardly thereof.

7. The method of dampening a planographic printing plate by the use of apparatus of the type described which comprises the steps of moving the plate continuously in one direction, applying liquid repellent onto the surface of the plate in excess of the amount required for use in the printing operation, directing a stream of air extending continuously crosswise of the plate as a blade onto the surface of the plate from an air nozzle having its exit opening extending continuously crosswise of the plate and positioned to direct the air stream onto the blade at an angle less than zero but greater than —30° to the normal of the plate whereby the excess repellent on the non-printing portions of the plate and repellent on the imaged portions is displaced rearwardly from the point of contact, and removing repellent displaced rearwardly onto the plate by suction means through a housing having its inlet opening co-extensive with an aligned with the exit opening of the nozzle and spaced immediately rearwardly thereof, introducing air into the nozzle for issuance under pressure from the exit opening as a continuous blade, and withdrawing air from the housing to such the excess repellent displaced rearwardly by the blade through the inlet opening into the housing for removal.

8. The method as claimed in claim 16 in which the air nozzle is positioned to direct the stream of air as a blade onto the surface of the plate at an angle between —10° and —30° with the normal.

References Cited in the file of this patent

UNITED STATES PATENTS

2,139,628	Terry	Dec. 6, 1938
2,366,926	Melton	Jan. 9, 1945
2,590,429	Ras	Mar. 25, 1952
2,604,848	Mullen	July 29, 1952
2,679,231	Pomper et al.	May 25, 1954