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Keller

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[54] **METHOD OF AND APPARATUS FOR CONTROLLING LITHOGRAPHIC PRINTING**

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[63] Continuation-in-part of Ser. No. 753,504, Aug. 19, 1968, abandoned.

[30] **Foreign Application Priority Data**

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Aug. 21, 1967 Germany ..... K 63149

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[51] **Int. Cl.** **B411 25/00,** B41f 31/00
[58] **Field of Search** 101/147, 148, 349, 101/350; 117/111; 118/5

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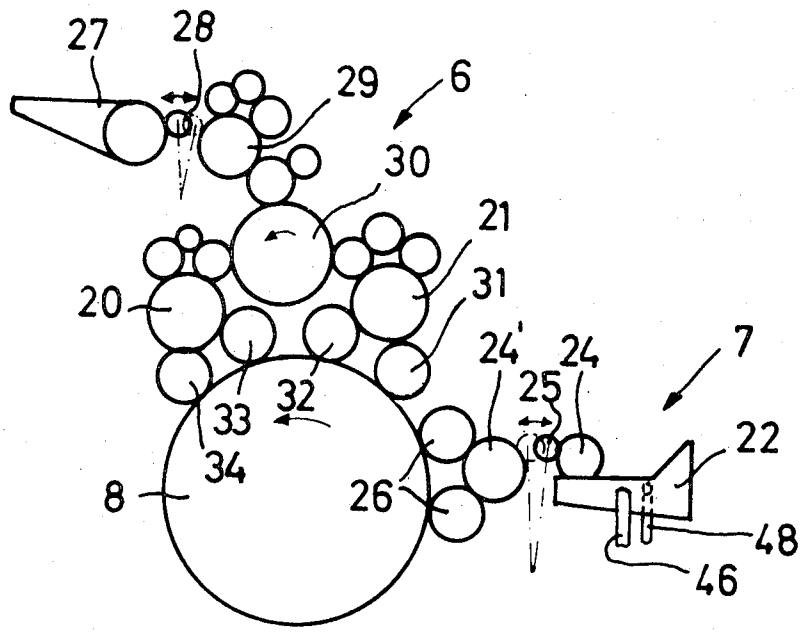
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[57] **ABSTRACT**

In a printing machine, means are provided to independently control the temperature of the wetting agent and also the temperature of the printing ink at least at two spaced locations in the inking unit.

17 Claims, 4 Drawing Figures



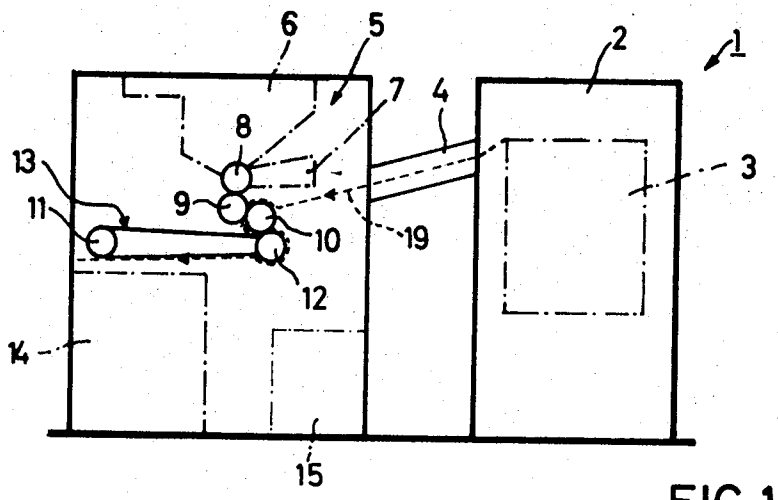


FIG.1

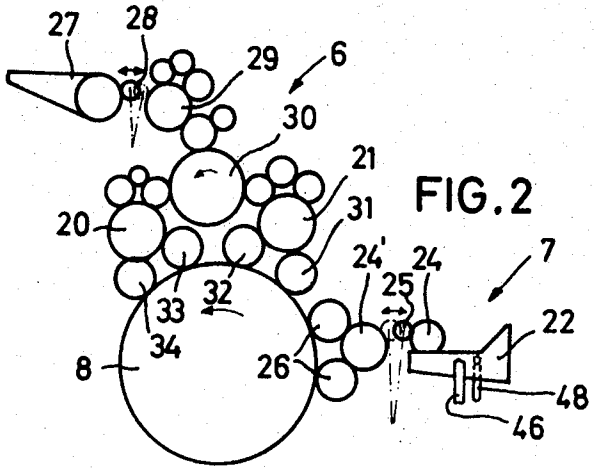


FIG.2

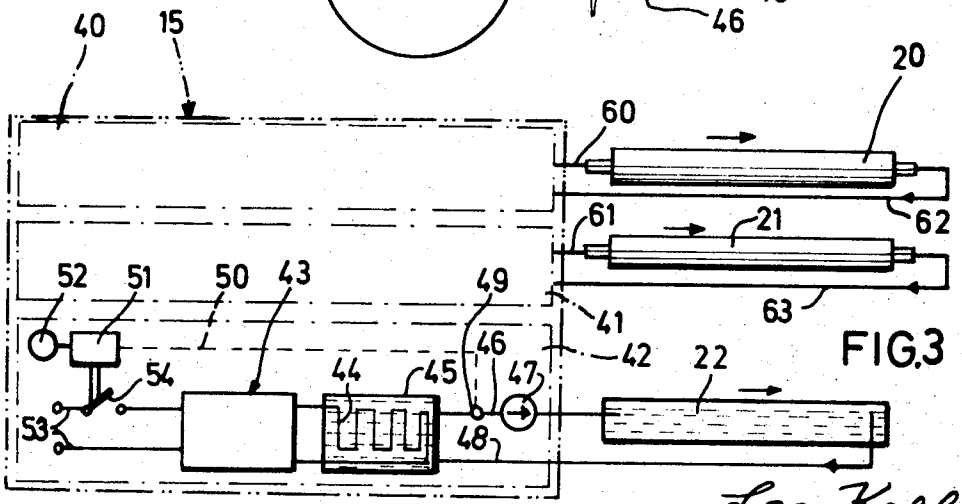


FIG.3

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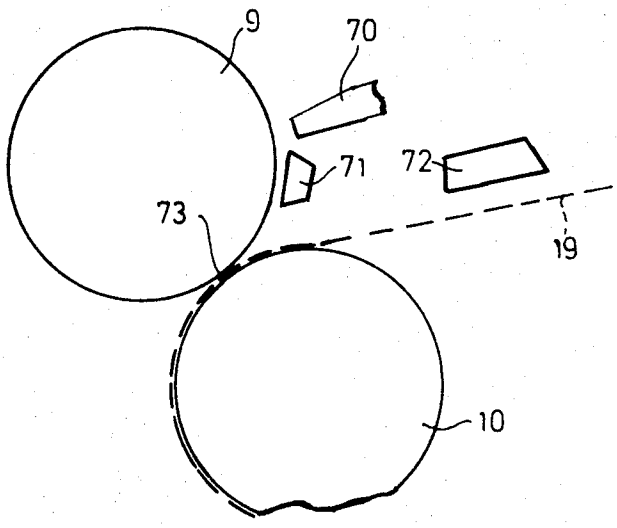


FIG. 4

METHOD OF AND APPARATUS FOR CONTROLLING LITHOGRAPHIC PRINTING

This application is a continuation-in-part application of application Ser. No. 753,504, filed Aug. 19, 1968 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a method of and an apparatus for controlling the printing operation particularly in offset printing machines having at least one printing assembly which includes an inking unit, a printing plate cylinder and a dampening device. The purpose of the latter is to apply a wetting agent to those portions of the printing plate to which no printing ink is allowed to adhere. The printing plate is therefore so designed that the wetting agent will adhere to the aforenamed portions as a very thin film. During the subsequent application of printing ink to the printing plate, ink will adhere only to those areas which are void of the moistening film.

In up-to-date rapid offset printing machines the printing speed or capacity is, from a technical and economical point of view, determined largely by the printer's ability as to how rapidly he succeeds to establish the most favorable relationship between the printing ink and the wetting agent for a given purpose. One of the important variables is the property of the article to be printed on, such as paper sheets, paper webs or other materials. By "printing ink" there is meant not only inks but any matter, such as a lacquer, which is applied as print to the article and which is delivered thereto by means of the inking unit. The continuous change in the operating conditions during the printing process presents a particular problem, since it causes fluctuations and irregularities which the printer can predict only with difficulty, if at all. In a large measure the reason of such fluctuations lies in the uncontrolled and heretofore unharnessed temperature fluctuations during the ink transfer within the printing machine. For this reason, the printer has to interfere frequently with the printing operation to vary the printing ink and the moistening qualitatively as well as quantitatively.

In known offset printing machines either only the temperature of the wetting agent or only the temperature of some of the rolls of the inking unit are controlled. With printing machines of this type it is not possible to obtain a printing process wherein the printing plate cylinder and thus the article receives a printing ink which has highly constant physical properties, particularly a constant viscosity and adhesion. The reason therefor is the merely local temperature control which does not take into account the prevailing interactions between the different temperature zones in the printing machine. Thus, even if the aforenoted localized temperature control exists, the printer, as before, has to vary the relationship between printing ink and wetting agent during the printing operation. Also, the initial setting of the relationship between the printing ink and the wetting agent is difficult and time-consuming and depends largely upon the skill of the printer. Further, the initially set relationship still varies during the printing operation.

OBJECTS AND SUMMARY OF THE INVENTION

It is a principal object of the invention to provide an improved method to control the printing operation in such a manner that the abovenoted disadvantages may be eliminated.

It is a further object of the invention to provide an improved printing method by means of which the transfer of printing ink per unit area on the article is increased without adversely affecting, but on the contrary, improving the sharpness of printing.

It is also an object of the invention to effect a more uniform print, and, further, to simplify the servicing of the printing machine by eliminating the necessity of frequent correction of the printing ink and water ratio and of the physical properties of the printing inks, and, should correction be necessary, by rendering the same easier and better surveyable than it has been possible heretofore.

It is a further object of the invention to provide printing inks which dry better on the articles than those used heretofore to thus diminish the danger of soiling the discharge means of the printing machine and also to increase the printing speed.

It is still another object of the invention to provide an improved method of the aforenoted type whereby an emulsification of the printing ink is substantially eliminated, so that a soiling of the transfer rolls of the dampening device with printing ink is entirely or substantially prevented and a more uniform transfer of the printing ink is ensured.

Briefly stated, according to the invention, during the printing operation, the printing ink is at least at two different locations of the inking unit, maintained at different, approximately constant, adjustable temperatures by means of cooling said locations of the inking unit. Further, the wetting agent which serves for the moistening of the printing plate cylinder is, prior to applying it to the printing plate cylinder, cooled to an approximately constant, adjustable temperature which is lower than the temperature or temperatures of the printing ink at the time the latter is received by the printing plate cylinder.

The most favorable temperatures may be determined prior to the printing operation by means of test printing or, may be set by consulting tables or other aids. The temperatures to be set are dependent from numerous variables, for example, the printing speed, the type of printing ink, wetting agent and article used, etc.

GENERAL ADVANTAGES OF THE INVENTION

By practicing the afore-outlined method according to the invention, it is possible, in contrast to the processes known heretofore, to apply the printing ink with constant chemical and physical properties and without substantial emulsification to the article and in particular, to maintain at a constant value the viscosity, surface tension, adhesion and other properties of the printing ink during the entire printing operation. This, however, may be achieved only if, according to the invention, the temperature of the printing ink and the temperature of the wetting agent are maintained simultaneously at an approximately constant value on the form rollers contacting the printing plate and thereby maintaining the temperature of the latter approximately constant as well. In this manner, the boundary surface tension be-

tween the wetting agent (for example water) and the printing ink is also maintained constant.

In known processes it is further a disadvantage that the rollers of the dampening device, because of the emulsification of the printing ink, become soiled to an increasing extent which causes a non-uniform and continuously changing supply of the wetting agent to the printing plate cylinder. By practicing the method according to the invention, this disadvantage is also eliminated since the boundary surface tension between printing ink and wetting agent may be maintained at practically constant values at which significant emulsification no longer occurs.

Also, by practicing the method according to the invention, all ingredients that enhance emulsification (such as alcohol) may be omitted from the wetting agent.

Further, if a printing method according to the invention is practiced, the printing inks used may be less expensive, yet technically superior to the printing inks used heretofore, because a wider range of selecting the ink components is now available. The reason is that in view of the printing method according to the invention a substantial heating of the printing ink in the inking unit and the danger of significant emulsification have no longer to be taken into consideration. By practicing the method according to the invention, the output or capacity of the printing machine may be in general substantially increased, since the auxiliary steps such as washing, etc. may be performed in less time. Also, during the entire workshift the unavoidable heat generation in the mechanical parts which normally has an adverse effect on the ink transfer no longer disturbs the latter in a printing operation according to the invention.

Further, it is a particular advantage that the printer, during the printing operation, no longer has to interfere with a frequency and extent required heretofore. Consequently, the servicing of the printing machine is simplified and the printing process is no longer dependent upon the experience of the printer to an extent as has been required heretofore.

Thus, when a printing method according to the invention is practiced, first the printer advises the suppliers of the article (e.g. paper sheets) and the printing ink concerning the required technical data of the printing operation. Thus, for example, the article supplier is notified that the resistance to pick test should be *x* and the required absorptive capacity should be *y;* the ink supplier is notified that for a given printing speed *a* the printing ink should have a flow *b* and should dry in a time unit *c* on a paper with an absorptive capacity *y*. The ink supplier then advises the printer that at what temperatures does the delivered ink possess the required values.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic side elevational view of a single-ink offset printing machine incorporating the invention;

FIG. 2 is a schematic side elevational view in more detail of a printing assembly forming part of the machine shown in FIG. 1;

FIG. 3 is a schematic side elevational view of an embodiment of the invention adapted to be associated with the assembly shown in FIG. 2; and

FIG. 4 is a schematic side elevational view at an enlarged scale of additional details of the printing assembly shown in FIG. 2.

GENERAL CHARACTERISTICS AND FURTHER ADVANTAGES OF THE METHOD ACCORDING TO THE INVENTION

In general, it is particularly advantageous if the temperature of the wetting agent is maintained lower than the temperature of the printing ink, for example, at generally less than +8° C, preferably close to 0° C. Frequently, temperatures under 0° C proved to be advantageous. It is to be understood that in such cases a wetting agent has to be used which does not freeze, such as water which contains an antifreeze. By thus cooling the wetting agent to a temperature which is below the temperatures of the printing ink applied, the ink residue on the printing plate subsequent to the previous printing operation and immediately prior to the application of the new printing ink (for example, for a printing speed of 7000 sheets/hour = approximately 56 msec) may be physically affected in such a manner that a possibility exists for the control of ink fusion. Further, by means of a wetting agent that is colder than the printing ink applied, the boundary surface tension between the printing ink and the wetting agent on the printing plate is increased which results in a substantial decrease of the emulsification factor.

It has been found to be particularly advantageous if the temperature of the printing ink, at least during application thereof to the printing plate, is in a range, the lower and upper limits of which are, respectively, the dew point temperature and the approximate room temperature.

It was further found to be particularly advantageous to establish a predetermined relationship between the temperature of the printing ink and the temperature of the wetting agent for each printing operation. This may be achieved by a corresponding setting of the controlled or regulated constant temperature values. Or, the temperature of the printing ink may be controlled or regulated as a function of the temperature of the wetting agent or conversely.

In order to improve the sharpness of printing, particularly in the boundary region between half tones and full tones, according to the invention, it may be provided that the printing ink is applied with different temperatures to the printing plate at least at two peripherally spaced locations thereof.

According to the invention, the temperature of the printing ink is controlled or regulated at least at one location of the inking unit preferably in such a manner that the printing ink, in the zone between the fountain and the transfer rollers engaging the form rollers, is maintained at approximately room temperature. This is preferably achieved by means of an appropriate cooling of the inking cylinder and if necessary, of additional rollers of the inking unit. It is expedient to maintain deviations from the room temperature at a relatively small value. It is preferred if such deviations are not more than ± 1°–2° C. It is further particularly advantageous to control or regulate the temperature of the printing ink in the zone of the transfer rollers engaging the form rollers and in the zone of the form rollers themselves by cooling the said transfer rollers and/or the form rollers independently from any preceding temperature control or temperature regulation. The

temperatures controlled or regulated in the zone of the form rollers and transfer rollers may have a value which lies expediently also in the vicinity of room temperature. This last-named temperature control or temperature regulation further serves for effecting corrections of the printing operation by adjusting the temperature of the printing ink in the range of its location of application to the printing plate and it further serves for the basic or initial setting for beginning of the printing operation. It is advantageous if at this location or locations the temperature of the printing ink may be set to different temperatures within a larger temperature range. It has been found by experimentation that a useful temperature range extends from approximately 6° C below the room temperature up to approximately 2°–3° C above the room temperature. It is understood that special conditions may require a narrowing or widening of this temperature range.

By means of the aforenoted preferred control of temperature of the printing ink in the inking unit, the printing ink, during its travel from the fountain to the form rollers, is at least in the zone between the fountain and the transfer rollers of the form rollers maintained at approximately room temperature. It is preferred if the printing ink temperature does not rise above its initial (room temperature) value. This feature makes possible the use of printing inks that have a relatively low viscosity, flow limit and adhesion. It is an advantage of low viscosity printing inks that they spread more easily and more uniformly on the rollers; in addition, smaller forces are required and thus the heat generation is reduced from roller to roller. Also, fewer rollers are necessary. Further, because of being close to room temperature, the printing inks may be combined with solvents having a relatively low boiling point which may be, for example, 20 percent lower than the boiling points of solvents used before. Thus, heretofore, for offset sheet printing, solvents having a boiling points of 240° C or more have been used. By practicing the method according to the invention, solvents may be used which have a boiling point of 200° C or less. By using such solvents, the inks dry faster on the article. This is of particular advantage when several printing inks are used in a sequential "wet-on-wet" printing process.

It has been found that the average value of a favorable flow limit of the printing ink at room temperature is 2000 dyn/cm², whereas heretofore such average value has been 3000 dyn/cm². When the method according to the invention is practiced, a printing ink may be used which, at room temperature, has a viscosity of approximately 50 poises. It is to be understood that this value is merely an average magnitude and that deviations therefrom in either direction dependent upon the pigment or other factors may be possible. In contradistinction, for offset sheet printing processes, printing inks have been heretofore used with an average viscosity of approximately 300 poises at room temperatures. Heretofore, these substantially higher initial viscosity values of the printing ink during the introduction thereof into the printing machine had to be reduced to the values required by the printing technology by the heat generation on the inking unit. These low viscosity values are now available as initial, or input values. It is a further advantage that the technological data of the printing ink and those pertaining to the article may now be expressed in temperatures. Stated in different terms, even the basic standard of the printing operation may be expressed in terms of data pertaining to the different controlled or regulated temperatures and during the printing operation, the necessary corrections may be effected by adjusting the controlled or regulated temperature values. It is a further advantage of the invention that in case several printing inks are used in a "wet-on-wet" printing process, the different viscosity, adhesion, etc. values required for the most satisfactory printing operation and ink sequence may be accurately set in advance without difficulty.

Because solvents of a more volatile nature may now be used in view of the invention, the drying of the ink on the articles is accelerated and thus the danger of ink deposition from a previously printed article to the next successive superpositioned article is reduced. Also, the operational speed of the printing machine may be increased. By virtue of the low viscosity and flow limit, the printing ink is exposed to less strain in the inking unit and its temperature is raised to a lesser extent than heretofore. Thus, to effect, according to the invention, a temperature control or regulation in the zone between the ink fountain and the transfer roller of the form roller, in most cases it suffices to maintain the temperature in this zone at approximately room temperature merely by cooling the inking cylinder. Further, owing to the easier spread of the thinner printing ink, it is possible to structurally simplify the inking unit by omitting some of the rollers used heretofore.

By means of the temperature control or regulation of the printing ink in the zone of the form rollers and the ink transfer rollers associated therewith, the optimal physical properties of the printing ink required for the transfer to the printing plate of the printing plate cylinder may be set. The method according to the invention constitutes a novel solution to set the printing operation and if necessary, to effect corrections during the course thereof. Instead of adapting the physical properties of the printing ink to the technological requirements of printing by changing their composition as it has been done heretofore, such adaptation is effected, according to the invention, by means of controlling the temperature of the printing ink at different locations of the printing machine. Among others, this has the advantage that the necessary corrections may be done rapidly, securely and in a reversible manner.

It can thus be seen that subsequent to an interruption of the printing operation, after the restarting, the stable or stationary printing conditions may be set more rapidly and in a more secure manner than it has been heretofore possible.

In general, it is particularly advantageous to apply the printing ink to the printing plate cylinder at least at two peripherally spaced locations thereof at different temperatures. It is hereby often preferred if the printing ink applied first to the printing plate cylinder (as related to the rotational direction thereof) has a higher temperature than the printing ink applied subsequently.

It has further been found advantageous to heat the article by radiation at a small distance prior to the location of printing, preferably to temperatures which are approximately 3°–20° C, preferably 3°–10° C, higher than the temperature of the printing ink when applied to the article.

According to the invention it may be further provided that the outer surface of the rubber cylinder is maintained at a constant adjustable temperature by blowing cold or warm air thereon during the printing

operation. In this manner the quantity of the printing ink per unit area to be transferred is controlled and may be set between certain limits. For this purpose, a heating or cooling of the rubber blanket may be effected. An irradiation of the blanket cylinder is effected only if a heating thereof is contemplated.

By means of the temperature control of all ink transfer operations an excessive admission of wetting agent to the article is practically prevented.

DESCRIPTION OF A PREFERRED EMBODIMENT FOR PRACTICING THE INVENTIVE METHOD

For performing the afore-described method, there is provided, for example, an offset printing machine which comprises at least one printing assembly including an inking unit, a printing plate cylinder and a dampening device and which, according to the invention, is provided with means to control or regulate the temperature of the wetting agent of the dampening device and/or the printing plate and the temperature of at least one roller of the inking device.

Turning now to FIG. 1, the offset printing machine generally indicated at 1 shown therein includes a stacking and sheet delivering device 2 containing an article stack 3, a forwarding table 4 and a printing assembly generally indicated at 5. The latter includes an inking unit 6 shown in more detail in FIG. 2, a dampening device 7, a printing plate cylinder 8, a rubber blanket roller 9, a printing cylinder 10, a discharge assembly including two parallel spaced rolls 11, 12, and an endless conveying means 13 which deposits the printed sheet on a stack 14.

With the printing assembly 5 there is associated a temperature control assembly 15 for the separate regulation of temperatures of ink transfer rollers 20, 21, inking cylinder 30 of the inking unit 6 and the wetting agent in dampening device 7. The temperature control assembly 15 is shown in more detail in FIG. 3.

It is to be understood that the invention is not limited to printing machines having only a single printing assembly. On the contrary, the invention may find application in any type of lithographic printing machine, such as an offset printing machine, irrespective of the number of printing assemblies. In case several printing assemblies are present, the temperatures of the inking units and the wetting agents of all dampening devices of the printing machine are controlled or regulated. Similarly, the printing machine may be of the endless printing type (roller printing machine) or, as shown, may be adapted for sheet printing.

Turning now to FIG. 2, the inking unit 6, the printing plate cylinder 8 and the dampening device 7 of the offset printing machine depicted in FIG. 1 are shown in greater detail. The dampening device 7 has a pan 22 for the wetting agent. The latter is continuously circulated in a refrigerating circuit (FIG. 3) and cooled to a constant temperature. By means of a pan roller 24, a transfer roller 24' and a ductor roller 25 oscillating between the rollers 24 and 24', the wetting agent is applied to two form rollers 26 and therefrom to the printing plate cylinder 8.

The inking unit 6 has a fountain 27 from which printing ink is drawn by means of a ductor roller 28 and applied to a transfer roller 29. From the latter the ink is transferred through a plurality of additional transfer rollers, of which the roller 30 is the so-called ink cylinder, to the transfer or spreader rollers 20, 21 and therefrom to a total of four form rollers 31, 32, 33 and 34 disposed circumferentially about and in contact with the printing plate cylinder 8. Form rollers 31 and 32 are in contact with spreader roller 21, whereas form rollers 33 and 34 contact spreader roller 20. The printing plate cylinder 8 applies the print pattern to the rubber blanket or envelope of the rubber or rubber coated cylinder 9 (FIG. 1) from which the pattern is then printed on the sheet while supported on its reverse face by the printing cylinder 10. The traveling path of the article (paper sheets in this instance) from the stack 3 to the stack 14 is indicated with broken lines 19 in FIG. 1.

According to the invention, the temperature of the wetting agent is also regulated. Means for such a temperature regulation is schematically shown in FIG. 3 and will be described hereinafter.

As shown in FIG. 4, there is provided a blow nozzle 70 which is adapted to blow cooled or heated air uniformly on the rubber coated cylinder 9 along its entire length a short distance before the printing location 73 for varying the surface temperature of the rubber blanket. In lieu of or in addition to the blow nozzle 70 there may be provided a heat radiator 71 adapted to apply heat by radiation to the cylinder 9 uniformly over its entire length. There is provided a further heat radiating device 72 at a short distance in front of the printing location 73 adjacent the path of the incoming blank sheet to effect, by means of heat radiation, a heating of the sheet face shortly before print is applied thereto.

Turning now to FIG. 3, the temperature control assembly 15 shown therein includes a plurality of separately controllable refrigerating devices 40, 41 and 42 which may be of identical structure and of which therefore only one (that identified at 42) is illustrated in more detail.

The refrigerating device 42 includes a conventional compressor-type refrigerator 43; an evaporator coil 44 disposed in a tank 45 which contains the wetting agent (such as water) cooled therein to a constant temperature; a supply conduit 46 through which the wetting agent is delivered from the tank 45 to the pan 22; a circulating pump 47; a return conduit 48 for carrying the wetting agent from the pan 22 into the tank 45; a temperature sensor 49 responsive to the supply temperature of the wetting agent; a regulator 51 operatively connected to the temperature sensor 49 through a conductor 50 indicated in broken lines; a desired value transmitting device 52 associated with the regulator 51 for applying thereto signals representing the desired set temperature value for the wetting agent and a switch 54 contained in the electric power line 53 of the refrigerator 43 and serving for the energization and deenergization of the compressor thereof.

The refrigerating device 42 operates in the following manner:

The wetting agent is driven by means of pump 47 from the tank 45 into the pan 22 and flows through the return conduit 48 back into the tank 45. Replenishing conduit means (not shown) are provided that lead to the tank 45 for continuously replacing the wetting agent taken from the pan 22 by the pan roller 24 (FIG. 2). The temperature sensor 49 measures the temperature of the wetting agent flowing towards the pan 22 and effects, through the regulator 51 and the switch 54, an energization of the compressor associated with the refrigerator 43 every time the temperature sensed by sensor 49 exceeds the predetermined value set by the

desired value transmitter **52.** As soon as the temperature of the wetting agent in the supply conduit **46** falls below a predetermined temperature value by virtue of the cooling effect of the energized refrigerator **43,** the regulator **51** causes opening of switch **54** and thus the refrigerator **43** is deenergized. In this manner the temperature of the wetting agent admitted to the pan **22** through the supply conduit **46** is maintained at an approximately constant value. The circulation of the wetting agent occurs in such a rapid manner that in the pan **22** no appreciable temperature increase of the wetting agent takes place.

The refrigerating devices **40** and **41** serve for the controlled cooling of the ink transfer or ink spreader rollers **20** and **21** for increasing the viscosity and adhesion of the printing ink immediately prior to its application to the printing plate cylinder **8.** A similar refrigerating device (not shown) is provided for the inking cylinder **30.** All cooling processes occur in a continuous manner.

From the supply conduits **60** and **61** of the refrigerating devices **40** and **41,** respectively, a coolant, for example, water, flows through the usual hose couplings axially into the rollers **20** and **21.** The latter are of a hollow structure so that the coolant may pass therethrough in an axial direction. Through rotary hose couplings and return conduits **62, 63,** the coolant returns into the refrigerating devices **40** and **41.** In each of the afore-described two refrigerating devices **40, 41,** the temperature of the supplied coolant is maintained by regulation at a constant, adjustable value (the same applies for the refrigerating device associated with the ink cylinder **30**). It is thus seen that each coolant, in the same manner as the wetting agent associated with the refrigerating device **42** is temperature-regulated and recirculated. The circulation of the coolants passing through the rollers **20, 21** and cylinder **30** occurs in such a rapid manner that at these members no appreciable temperature change occurs. The thickness of the circumferential walls of these members is designed that their outer surface temperature approximately corresponds to the temperature of the coolant flowing therethrough.

It is thus seen that the temperatures of rollers **20, 21** and cylinder **30** and the temperature of the wetting agent may be maintained independently from one another at different set values by means of the aforedescribed regulation. It is to be understood that the temperature regulation of the rollers **20, 21, 30** and the wetting agent may be effected in any other appropriate manner.

In the preferred embodiment described hereinabove, it may be expediently provided that the spreader roller **20** is maintained at a temperature that is lower than that of the spreader roller **21.** The temperature of the wetting agent may be generally and advantageously lower than the temperatures of both rollers **20** and **21.**

By maintaining the temperature of the roller **20** lower than that of roller **21,** there is obtained a sharper or more defined printing, particularly in the border zone between half tones and full tones, because the warmer ink is applied more strongly or profusely whereas the colder ink counteracts the tendency of a running or enlarging of the grid dots.

It is to be understood that, if necessary, other or additional rollers of the inking unit **6** (for example, one or more transfer rollers **31–34**) may also be temperature controlled or temperature regulated.

Also, instead of or in addition to a temperature control of the wetting agent in the pan **22,** the temperature of at least one roller of the dampening device **7,** preferably pan roller **24,** may be controlled. In some cases, on the other hand, it is sufficient if merely a single roller of the ink unit is temperature controlled or temperature regulated.

Example 1

a. Printing with ink at a room temperature of 22° C:

Temperature of inking cylinder 30	+22° C
Temperature of roller 20	+14° C
Temperature of roller 21	+19° C
Temperature of the wetting agent	+ 4° C
Temperature of the article	+25° C

b. Subsequent application of a superposed with lacquer on the same article under identical printing speeds:

Temperature of inking cylinder 30	+20° C
Temperature of roller 20	+19° C
Temperature of roller 21	+22° C
Temperature of the wetting agent	0° C
Temperature of the article	+25° C

Example 2

Room temperature: 22° C

The ink fountain is filled with a printing ink, the viscosity of which is approximately 50 poises at room temperature and the flow limit of which at room temperature is approximately 2000 dyn/cm^2.

The large inking cylinder **30** of the inking unit is set at a temperature of approximately 20° C.

The temperature of the spreader roller **21** of the first form roller pair **31, 32** is set to 22° C and the temperature of the spreader roller **20** of the second form roller pair **33, 34** is set at 19° C.

In the dampening device **7** the temperature of the pan roller **24** is set at +1° C so that the wetting agent (such as water), accordingly, assumes a temperature of +1° C.

The outer surface of the rubber blanket of the cylinder **9** is maintained at a temperature of approximately 22° C; for this purpose temperature regulated air is blown by the nozzle **70.**

The temperature values given in the above examples represent the basic operational values which, in case temperature corrections are to be effected, are adapted by a positive or negative alteration, to the desired print-technological requirements.

What is claimed is:

1. In a method of controlling the printing on articles by means of offset printing machines of the type that include at least one printing assembly having a printing plate cylinder, a dampening device for applying a wetting agent to said printing plate cylinder, and at least one inking unit for applying printing ink to said printing plate cylinder, said inking unit including ink fountain means, the improvement comprising the steps of

A. transferring ink within one and the same inking unit from said ink fountain means along at least two separate ink paths to the printing plate cylinder at locations peripherally spaced from one another,

B. cooling the ink in each ink path to different predetermined temperatures for applying the printing

ink to said printing plate cylinder with different temperatures at least at two peripherally spaced locations thereof,

C. maintaining each said predetermined temperature of the ink in each ink path approximately constant and

D. cooling said wetting agent prior to its application to said printing plate cylinder to an approximately constant, predetermined temperature which is lower than any temperature of the printing ink at the time of the application of the latter to said printing plate cylinder.

2. A method as defined in claim **1**, wherein said one and the same inking unit includes an inking cylinder receiving ink from said ink fountain means, spreader rollers receiving ink from said inking cylinder and form rollers receiving ink from said spreader rollers and being in contact with said printing plate cylinder, each said ink path having a separate set of spreader and form rollers, including the step of regulating the temperature of said inking cylinder.

3. A method as defined in claim **1**, wherein said one and the same inking unit includes spreader rollers receiving ink at least indirectly from said ink fountain means and form rollers receiving ink from said spreader rollers and being in contact with said printing plate cylinder, each said ink path having a separate set of spreader and form rollers and in step (B) selecting the temperature values so that the printing ink has approximately room temperature in that portion of the ink paths that extends between said ink fountain means and said spreader rollers.

4. A method as defined in claim **1**, wherein said one and the same inking unit includes spreader rollers receiving ink at least indirectly from said ink fountain means and form rollers receiving ink from said spreader rollers and being in contact with said printing plate cylinder, each said ink path having a separate set of spreader and form rollers and regulating wherein the temperature of the printing ink in the zone of said spreader rollers and in the zone of said form rollers independently from any other preceding temperature regulation by cooling at least some of the last-named rollers.

5. A method as defined in claim **1**, applying the printing ink to the printing plate cylinder sooner, when viewed in its rotational direction, at a temperature higher than that of the printing ink applied subsequently.

6. A method as defined in claim **1**, selecting the temperature values in step (B) so that the printing ink, at least during its application to the printing plate cylinder, has a temperature within a range whose lower limit is the dew point temperature and whose upper limit corresponds approximately to room temperature.

7. A method as defined in claim **1**, selecting the temperature defined in step (D) to a value less than +8° C.

8. A method as defined in claim **1**, including the step of heating, by means of heat radiation, the top face of the advancing article shortly ahead of the location of printing.

9. A method as defined in claim **8**, heating said article by said heat radiation to a temperature that is greater than the temperature of the printing ink when applied to said article.

10. A method as defined in claim **1**, transfering the printing ink from the printing plate cylinder to a rubber cylinder and therefrom to the article, including the step of maintaining the temperature of the outer surface of said rubber cylinder at an approximately constant, predetermined value during the printing operation.

11. A method as defined in claim **10**, including the step of irradiating the outer surface of said rubber cylinder.

12. A method as defined in claim **10**, including the step of blowing temperature-regulated air on the outer surface of said rubber cylinder.

13. In an offset printing machine of the type that includes at least one printing assembly having (*a*) a printing plate cylinder, (*b*) a dampening device for applying a wetting agent to said printing plate cylinder and (*c*) an inking unit for applying printing ink to said printing plate cylinder, said inking unit includes an ink fountain means, the improvement comprising,

A. at least two separate ink paths extending from said ink fountain means to said printing plate cylinder within one and the same inking unit for transferring ink from said ink fountain means to said printing plate cylinder at locations peripherally spaced from one another,

B. means for cooling the ink in each ink path to different predetermined temperatures for applying the printing ink to said printing plate cylinder with different temperatures at least at two peripherally spaced locations thereof,

C. means for maintaining each said predetermined temperature of the ink in each ink path approximately constant and

D. means for cooling said wetting agent prior to its application to said printing plate cylinder to an approximately constant, predetermined temperature which is lower than any temperature of the printing ink at the time of the application of the latter to said printing plate cylinder.

14. An improvement as defined in claim **13**, wherein said inking unit includes spreader roller means receiving ink at least indirectly from said ink fountain means, form roller means receiving ink from said spreader roller means and being in contact with said printing plate cylinder, each said ink path being formed of a separate set of spreader and form rollers.

15. An improvement as defined in claim **14**, including means for separately controlling the temperature of at least one roller in each said ink path.

16. An improvement as defined in claim **14**, wherein said last-named roller is a spreader roller.

17. An improvement as defined in claim **13**, wherein said dampening device includes a plurality of transfer rollers, said improvement comprises means to regulate the temperature of at least one of said last-named rollers for controlling the temperature of said wetting agent.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,741,115 Dated June 26, 1973

Inventor(s) Leo Keller

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 10, lines 63 and 64 (claim 1) delete "at least two separate ink paths" and insert therefor --an ink path, formed at least along a downstream terminal portion thereof as at least two separate ink paths,--

Col. 11, line 39 (claim 4), delete "wherein"

Col. 12, line 23 (claim 13), delete "at least two separate ink paths" and insert therefor --an ink path--; line 25, after "unit" insert --, said ink path being formed at least along a downstream terminal portion thereof as at least two separate ink paths--

Signed and sealed this 20th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents