Sept. 7, 1943. F. G. BREYER 2,329,152

METHOD AND APPARATUS FOR PRINTING

Filed July 11, 1940 2 Sheets-Sheet 1

Fig. 1.

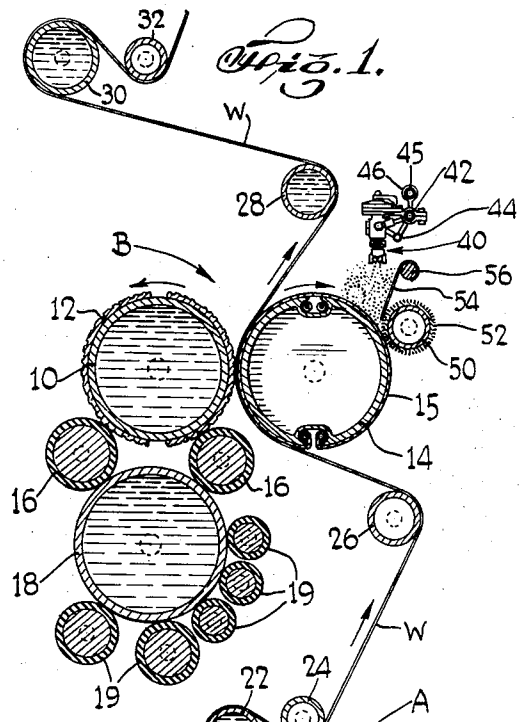


Fig. 2.

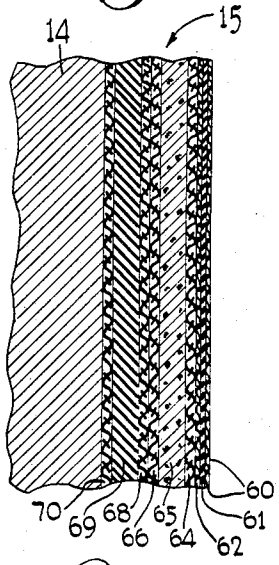


Fig. 3.

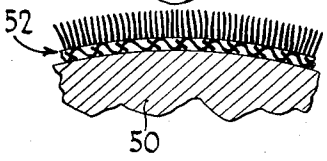
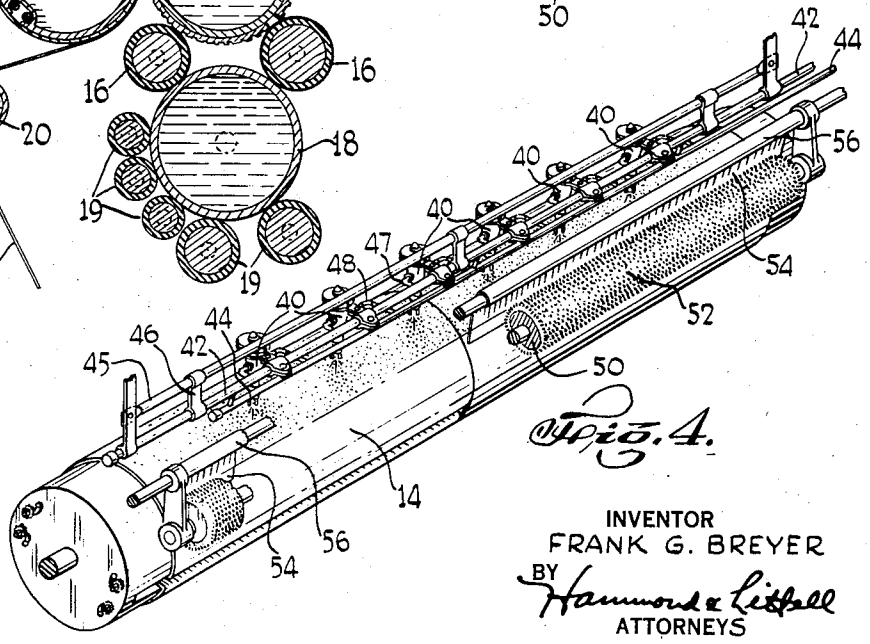


Fig. 4.



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Fig. 5.

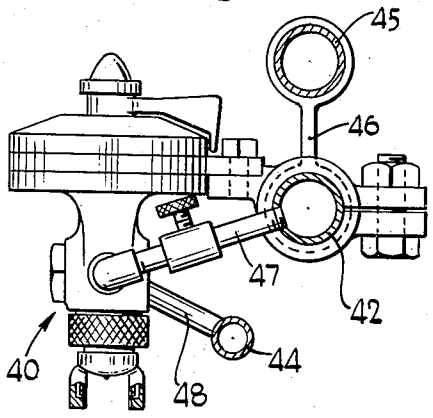


Fig. 6.

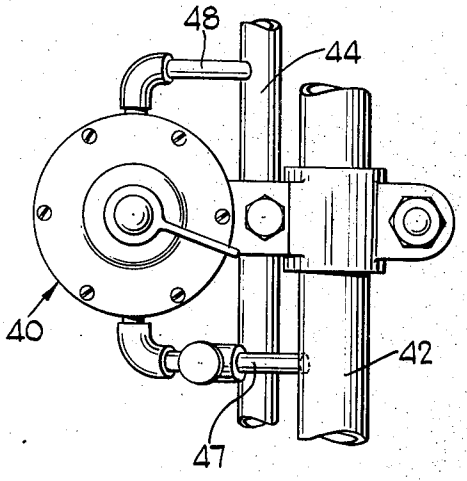


Fig. 7.

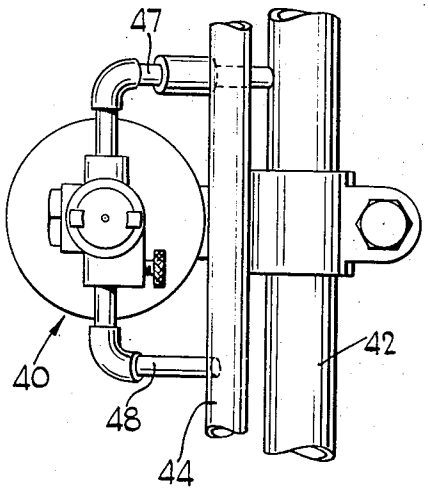
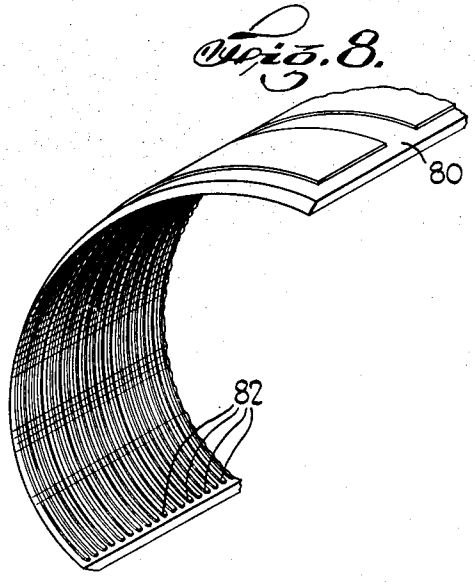


Fig. 8.



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UNITED STATES PATENT OFFICE

2,329,152

METHOD AND APPARATUS FOR PRINTING

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Application July 11, 1940, Serial No. 344,885

21 Claims. (Cl. 101—426)

This invention relates to new methods and apparatus for printing and particularly to improvements for use in the commercial printing of newspapers, magazines and other literature at high printing speeds according to the recently developed "cold set" printing process. The "cold set" process, as disclosed in a co-pending application of Walter Huber, Serial No. 288,113, filed August 3, 1939, involves the printing of molten thermo-fluid ink at elevated temperatures from a heated printing form onto a relatively cool sheet or web in films so thin that the printed films become set by freezing immediately upon leaving the printing surfaces and form a permanent solid print adhering to the surface of the paper.

It has been supposed heretofore the the "cold set" process would be applicable to high speed newspaper printing presses, which print at web speeds of from 600 to 1500 linear feet per minute, with as little difficulty as to magazine presses or other presses of the carriage type, which usually run at web speeds of several hundred feet per minute. This has been based on the observation that the setting agent which causes the ink films to solidify is the "cold" of the paper; that is to say, the ink films become set by absorption of heat therefrom into the paper, and as the speed of printing is increased the paper and the heat absorbing capacity are supplied at a correspondingly increased speed.

In attempting to apply the process to high speed newspaper printing, however, unanticipated difficulties were encountered which, prior to the present invention, seemed to preclude the practical use of the process for newspaper work with existing types of high speed newspaper presses. When both sides of the paper were so printed, it was found that some of the solid ink tended to scrape off the web during its passage over angle bars and folders, and from time to time this material would make streaks on the paper. The print of the first impression tended to stick to the surface of the second impression cylinder, and whenever this occurred the print was damaged or the web would tear. Also, the print on the finished web was somewhat tacky and rough, so that the printed sheets tended to stick together and did not "fly" properly while being turned and assembled in the folder and on the distribution tables. These and other difficulties made it impossible to operate successfully and obtain printed matter of the desired quality while printing both sides of the web at the necessary high printing speeds.

The principal object of this invention is to provide improved methods and apparatus which will overcome the above-mentioned difficulties and facilitate successful application of the "cold set" printing process to the commercial printing of newspapers, magazines and other literature with various types of high speed printing presses. One of the more specific objects of the invention is to provide a practical way of avoiding damage to finished prints of thermofluid printing ink during the printing of molten films of such ink from a heated printing form onto the other side of the same stock, or during passage of the print over angle bars and folders. Another object is to keep the side first printed from sticking to the second impression cylinder. Another object is to improve the quality and appearance of the printed matter and to produce at high printing speeds printed matter both sides of which bear prints of high and uniform quality. Still another object of the invention is to provide new and improved features of equipment and operation which may be used to advantage in various embodiments of the "cold set" printing process.

I have found that much of the trouble heretofore encountered in high speed newspaper printing by the "cold set" process can be traced to operating conditions which attend the use of certain types of high speed newspaper presses for that purpose. In a commonly-used type of newspaper press the printing cylinder and the impression cylinder of each printing mechanism are mounted in closely-spaced relation, and the printing mechanism which prints the first side of the paper web is spaced only a small distance from the printing mechanism of the second impression, which prints the opposite side of the same web. When the paper web travels at a speed of 600 to 1500 linear feet per minute through such a printing press unit, only an instant of time is available in which to condition the thermo-fluid ink films printed by one impression so that the print will not be damaged by contact with an impression cylinder of another impression or by passage over guide rollers, angle bars and folders. Also, a web running at such high speeds must be subjected to a strong pulling tension, so that there is a greater tendency to produce streaks and scrape solid ink from the web during its travel through the press than occurs when the tension on the web is lower. In addition to these factors, the inking rollers and printing form of each printing mechanism must be maintained at elevated temperatures substantially above the melting range of the thermo-fluid ink that is being printed, and heat transfer from these heated parts inevitably brings other parts of the press to abnormally high temperatures. The surfaces of the impression cylinders especially tend to be heated to high temperatures by contact and heat exchange with the adjacent hot printing forms, and when the two printing mechanisms of each press unit are spaced apart only a small dis-

tance, or when two or more press units are arranged quite close to each other, there is a further tendency for the impression cylinders and other unheated parts of the press to become quite warm. Under these conditions, it is difficult to produce mar-resistant prints of high quality, and if a satisfactory print of theremo-fluid ink has been produced on one side of the web this print is likely to be damaged by passage in contact with a hot impression cylinder during the printing of the other side and by subsequent passage over angle bars, folders, etc.

In accordance with the present invention, I have discovered that printing troubles resulting from these operating conditions can be overcome by carrying out the printing process with thermo-fluid ink having certain special physical qualities, by specially controlling the printing temperature of the ink and the subsequent treatment of the print, and by using a new method which protects the print of the first impression against damage during and after the printing of a second impression on the other side of the same web. In addition, various other new features, hereinafter described, may be used to advantage in certain embodiments of my invention.

In previous practice of the "cold set" process thermo-fluid ink has been printed at a consistency similar to that or ordinary liquid printing ink. In high speed printing of newspapers or other literature according to this invention, I use molten thermo-fluid ink at a fluidity much in excess of the fluidity of ordinary liquid printing ink. This increased fluidity is attained ether by providing an ink composition with exceptionally high fluid characteristics when molten, or by the use of exceptionally high printing temperatures during the printing of the ink, or preferably by a combination of both factors. The high fluidity and high temperature of the ink when printed enable the printed films to flatten out and conform to the surface of the web before they freeze to a rigid form, thereby improving the quality of the print and reducing the tendency of the ink to scrape off when passing over angle bars and other obstructions, such as may result if the printed films freeze too suddenly or otherwise become set while they project appreciably above the surface of the web.

I have also found it important to chill the ink films of each impression directly after they have been printed on the web, as by contracting the printed films with the surface of a cold roller, before they pass through another printing mechanism or over angle bars or folders. This chilling imparts a surface hardness and scrape-resistance to the ink films which they do not possess if allowed to attain their final hardness by normal cooling.

As another important feature of this invention, I avoid damage to the print of the first impression while making a second impression on the opposite side of the web and passing the same over angle bars, folders, etc., at high printing speeds, by providing a new treatment for the impression cylinder of the second impression which protects the print against marring or abrasion. A small amount of liquid is constantly supplied to the surface of the impression cylinder during the printing operations, which liquid adheres as a film and comes in contact with the print of the first impression and actually protects the printed ink films, by a sort of lubricating action, during and after the printing of the second impression, instead of damaging the print or the paper as normally would be expected. The liquid preferably employed in practice is volatile at the printing temperatures used on the press, so that it also acts to keep the surface of the impression cylinder at a suitably low temperature, by evaporation, notwithstanding the high temperature conditions which may prevail on the surface of the printing form. I generally employ unheated water as the treating liquid, and the water preferably carries a small percentage of a suitable lubricant, such as lubricating oil emulsified therewith, so that there is constantly maintained on the impression cylinder surface, and between the same and the web, a very thin film of lubricant that prevents sticking of the print to the impression cylinder even when the operation of the press is slowed down or stopped temporarily.

The treating liquid is preferably applied to the impression cylinder in the form of a finely divided spray, or mist, which may be produced by forcing a suitable water-oil emulsion through atomizing spray nozzles under air pressure. In addition, it has been found advantageous to equip the printing mechanism with means for keeping the liquid distributed uniformly on the surface of the impression cylinder and for promoting evaporation from the liquid to hold its temperature in a suitable range. In preferred embodiments of the invention this means comprises a roller having a pile surface of plush or other similar material, which roller is mounted for rotation adjacent to the impression cylinder with its pile surface in contact with the impression cylinder surface. The plush roller also entraps the spray liquid and keeps it from flowing off of the impression cylinder.

An illustrative embodiment of these and other features of my invention is described more specifically hereinafter with reference to the accompanying drawings, forming a part hereof, in which

Figure 1 shows diagrammatically, in vertical cross section, the principal elements of one type of newspaper printing unit equipped for use in accordance with this invention;

Figure 2 is a fragmentary, enlarged vertical section through the periphery of one of the impression cylinders, showing a preferred construction therefor.

Figure 3 is a fragmentary, enlarged vertical section through the periphery of the special roller cooperating with the impression cylinder at the second impression.

Figure 4 is a perspective view showing the spray-forming system associated with the printing mechanism of the second impression;

Figures 5, 6 and 7 show the construction and mounting of suitable spray-forming apparatus; and

Figure 8 is a perspective view showing part of a stereotype printing plate constructed especially for use in the practice of the invention.

As shown in the drawings, the illustrated printing unit consists of two printing mechanisms A and B which print molten thermo-fluid ink onto opposite sides of a paper web W. Each printing mechanism comprises a printing cylinder 10 that carries a printing form 12, and an adjacent, cooperating impression cylinder 14. Each printing form 12 runs in contact with resilient inking rollers 16 which engage a metal inking roller 18 and, with the latter and ink distributing rollers 19, constitute parts of an inking mechanism that

feeds molten thermo-fluid ink from a suitably heated ink fountain (not shown) and distributes the ink uniformly in thin films onto the relieved printing surfaces of the rotating printing form 12. The web W runs from a supply source (not shown) over a roller 20, thence through the first printing mechanism A where one side of the paper is printed, thence over a water-cooled roller 22 which chills the ink films printed at A, thence over guide rollers 24 and 26 and through the second printing mechanism B, thence over another water-cooled roller 28 which chills the ink films printed at B, thence over another water-cooled roller 30 which re-chills the print of the first impression and from 30 over a guide roller 32 and to other parts of the press (not shown) which fabricate the printed web into sheets and fold and assemble them into finished newspapers.

The printing form and inking mechanism of each printing mechanism must be provided with means for heating and maintaining the same at elevated printing temperatures substantially above the melting range of the thermo-fluid ink. While various heating systems may be used, the drawings indicate the use of hot water as the heating medium, preferably according to the system disclosed and claimed in a co-pending application of Lynn B. Case, filed May 18, 1940, now United States Patent No. 2,260,364. Only the printing cylinders and metal rollers of the inking mechanisms are directly heated, and separately-controlled heating systems preferably are used for them so as to hold the rollers of the inking mechanism at a substantially lower temperature than the printing forms.

The composition rollers 16 and 19 of the inking mechanism run freely in contact with the driven metal rollers 18 and become heated on their surfaces by heat exchange with the metal rollers. The printing form 12 receives its heat by conduction from the hot printing cylinder 10. Inasmuch as high heating temperatures are used in preferred embodiments of this invention, I find it desirable to use at 16 and 19, in each printing mechanism, resilient inking rollers surfaced with a heat-resistant rubber-like composition, such as Ameripol, neoprene, Thiokol or the like. The usual rubber inking rollers of newspaper printing presses have been found to deteriorate rapidly under such temperature conditions.

In practice of the present invention, a thermo-fluid ink is used which possesses an exceptionally high fluidity at temperatures substantially above its melting range. The viscosity of ordinary liquid newspaper printing ink is greater than 30 poises at 70° F., whereas the viscosity of the molten ink when printed according to this invention should be less than 10 poises. (Viscosities determined by Brookfield "Synchro-lectric" viscosimeter.) The temperature of the hot water circulated through the printing cylinders is kept high enough, with the water under pressure, to hold the ink films on the printing surfaces of the form 12 at elevated temperatures well above 210° F., water temperatures between 220° and 260° F. generally being used.

At the high printing temperatures employed, the thermo-fluid ink not only should have an exceptional fluidity but also should possess sufficient body and cohesiveness to be fed and distributed readily on the press and to adhere evenly to the printing surfaces at high printing speeds; yet the molten ink should be free from objectionable thixotropy, or "false body," and the films should part readily from the printing surfaces when they touch the paper web. At ordinary temperatures the ink should be distinctly hard and substantially free from tack. Such thermo-fluid ink, for example, may consist of coloring pigment incorporated in a solid vehicle composed largely of hard thermo-plastic resin, a small amount of hard wax for tack reduction and a minor proportion of hard wax-like liquefying material, such as hydrogenated soya bean oil. The hard resin material preferably consists mainly of cumarone resin, for example Cumar V-2½, with a smaller proportion of gilsonite. The gilsonite imparts the desired length to the molten ink and reduces "false body," while the cumarone imparts toughness, hardness and the like. In place of cumarone resin, hard thermo-plastic rosins and rosin derivatives may be used, such as hydrogenated rosin ester gum, wood rosin, limed rosin, etc. While various other compositions may be found which possess the physical qualities desired for the practice of my invention, I have found that suitable inks for high speed newspaper printing are obtained, for example, by incorporating pigments of the desired color in a solid vehicle containing about 25 to 40% of Cumar V-2½, about 15 to 30% of gilsonite and about 30 to 45% of soya bean stearine, with less than 15% carnauba wax. These inks are claimed per se in my co-pending application, Serial No. 344,847, filed July 11, 1940.

The combination of high ink fluidity and high printing temperatures permits the desired printing results to be obtained at fast web speeds by assisting the ink films to leave the printing surfaces readily and to flatten out and conform to the surface of the web before they become set, thus improving their quality and scrape-resistance. Nevertheless, the printed films do not penetrate substantially into the paper. This combination also avoids objectionable changes in ink fluidity or printing results which otherwise might result from variations in the printing temperature such as are likely to occur in the practical operation of heated printing presses.

The chilling of the print of each impression by contact with the water-cooled roller 22 or 28 also is a factor in obtaining the desired printing quality and scrape-resistance, as the ink films so treated are superior in hardness, gloss and scrape-resistance to thermo-fluid ink films which have been allowed to attain their final hardness without chilling.

A further factor influencing the printing results is the temperature of the paper web supplied to the printing unit. The paper is shipped and stored in large rolls, and its temperature when used on the press depends largely on the conditions under which the rolls have been produced and shipped. With the paper at average temperatures it may be printed as it comes from the rolls, but when the temperature of the paper is quite low it is desirable to warm the web somewhat before it passes into the first printing mechanism A. For this purpose, the roller 20 is made hollow and equipped with a suitable water circulation system for circulating hot water therethrough. If the paper supply has an abnormally high temperature, cooling water may be circulated through the roller 20 so as to reduce the temperature of the paper to a satisfactory range before the web passes to the first printing mechanism.

It will be evident that the continuous contact

or close proximity between the impression cylinders 14 and the hot printing forms 12 inevitably raises the surfaces of the former to a high temperature. In the printing of the first impression, at A, this high temperature condition on the surface of the impression cylinder may cause no damage, since the web does not become heated to a point which would adversely affect the setting qualities of the ink printed from the first printing form. During the second-side printing at B, on the other hand, the finished print of the first impression passes in contact with the heated surface of the second impression cylinder, and this contact tends to destroy the effect of the chilling roller 24 and to cause such irregularity or "picking" of the ink films as to result in scraping troubles during subsequent passage of the web over angle bars and folders. Furthermore, the print of the first impression has a substantial area of contact with the surface of the second impression cylinder, and if the latter is quite hot this may result in such fusion of the ink films as to cause the first print to stick and hold the web to the second impression cylinder.

These troubles are overcome by means of the special liquid treatment provided for the second printing mechanism B, using a new system of apparatus such as illustrated in Figure 1 and Figure 2. A plurality of atomizing spray nozzles 40 are arranged longitudinally with respect to the second impression cylinder and positioned so as to direct a finely divided liquid spray or mist onto the surface of the impression cylinder. The nozzles 40 are connected with a common supply pipe 42 through which the treating liquid is conducted. They are also connected with a common supply pipe 44 for compressed air. The nozzles themselves may be of any conventional construction suitable for converting liquid into an atomized or finely-divided spray form under air pressure. A typical construction and assembly for each nozzle are shown in Figures 4, 5, 6 and 7, wherein 45 is a support from which the supply pipes and nozzles are suspended by hangars 46, 47 are branch pipes leading from the liquid supply pipe to the nozzle units, and 48 are branch pipes leading from the air supply pipe 44 to the nozzle units. When liquid and compressed air are supplied through pipes 42 and 44, rsepectively, a finely divided liquid spray is produced from each of the nozzles 40 and directed onto the surface of the second impression cylinder, thus maintaining thereon a lubricating or protecting film of liquid which, in my preferred embodiments, keeps the impression cylinder surface from exceeding a suitable operating temperature and contacts the print of the first impression and protects it from damage during and after its contact with the second impression cylinder. Further, the treating liquid preferably used prevents overheating of and moistens the paper stock, which improves its strength and tear resistance and removes static.

As described hereinabove, I prefer to use as the treating liquid water emulsified with a small percentage of lubricating oil, so that the liquid not only has a temperature-limiting and protective effect during the printing operations but also at other times maintains on the surface of the impression cylinder, and between this surface and the first-side print, a thin protective film of lubricant which prevents the web from sticking to the second impression cylinder. The water component of this liquid remains at a satisfactory temperature, notwithstanding the high temperatures prevailing on the printing form, by evaporation. In order to promote evaporation and to maintain the desired distribution of the liquid film on the impression cylinder surface, a special roller 50 is mounted in parallel relation to the second impression cylinder, and this roller 50 is equipped with a pile surface 52, preferably of plush material, which constantly contacts the impression cylinder surface and rotates as a result of friction therewith. As seen in Figure 1, the atomized spray from the nozzles 40 may be applied partly ot the impression cylinder surface and partly to the pile surface of roller 50. With the use of this system, damage to the print of the first impression is avoided while printing a second impression on the other side of the same web, and a finished web printed on both sides is continuously produced, at high or low printing speeds, which can be passed directly over angle bars and folders without ruining the quality of the printed matter.

As indicated in Figures 1 and 4, a shield 54, made of felt or other suitable material, may be provided between the second impression cylinder 14 and a support 56 near the spray nozzles 40. This shield confines the liquid spray to the intended location and keeps it from escaping to places where the presence of water or oil would be objectionable.

As indicated schematically at 15 in Figure 1, the impression cylinder 14 of each printing mechanism is formed with a blanket of elastic cushioning material which yields under the pressure of the printing surfaces on the printing forms 12. In conventional newspaper printing practice these blankets comprise several layers, the outermost of which is surfaced with rubber or rubber-like thermo-plastic material. In the practice of the present invention, however, the high temperatures prevailing on the printing form and the continual impact and pressure of printing surfaces moving at high printing speeds tend to soften the surfaces of such impression cylinders and to cause such indentation and marring thereof as to interfere seriously with the desired printing results. I have found it possible to avoid these troubles by providing each impression cylinder 14 with a surface covering 60 of thin finely-woven fabric, such as balloon cloth, supported by suitable blankets of elastic cushioning material. For example, the top sheet of the cylinder may consist of balloon cloth layers 60 and 62 laminated with a thin intermediate layer 61 of rubber or rubber-like composition. The top sheet rests on a laminated blanket consisting of coarse fabrics 64 and 66 and an intermediate layer 65 of cork composition, and between this blanket and the metal surface of the roller is another elastic blanket consisting of coarse fabrics 68 and 70 laminated with a layer 69 of rubber or rubber-like composition. The balloon cloth surface sheet is generally coated with a thin wash of aluminum powder and synthetic resin. In this way I have found it possible to keep the impression cylinders smooth and uniform under the conditions encountered in high speed printing operations, as set forth and claimed specifically in my co-pending application, Serial No. 344,886, filed of even date herewith, now United States Letters Patent No. 2,233,357.

When printing with cast stereotype printing plates according to the present invention, it is also advantageous to employ a special construction of the stereotype plates which avoids difficulties encountered with plates of conventional construction. The latter are usually cast with

widely-spaced ribs on their back sides, which ribs form spacious air pockets of low heat conductivity between the plates and the heated printing cylinders. I have found that problems resulting from this low heat conductivity can be remedied by using cast stereotype plates, as indicated at **80** in Figure 8, having closely-spaced ribs **82** on their back sides, a spacing of about ¼ inch or less being satisfactory. In this way the rib formation and its advantages in the casting of the plates are retained, yet the problem of obtaining adequate heat transfer to the printing surfaces is solved.

Before the start of actual printing operations, the printing forms and inking mechanisms of the printing press must be brought to the desired operating temperatures, which is accomplished by establishing circulation of hot water through the hollow printing cylinders and through the metal rollers of the inking mechanisms and by allowing the press to run idle for a period of time sufficient to establish the desired temperature conditions. The ink is melted in suitable supply tanks and admitted to heated ink fountains associated with the inking mechanisms. The press is then started in operation with the web W passing therethrough at a high speed and with the printing forms and impression cylinders rotating at peripheral speeds corresponding to the web speed. The web first enters the bite between the form **12** and the impression cylinder **14** of the first impression mechanism A, at which point hot molten films of thermo-fluid ink are impressed on that side of the web contacted by the printing form. These hot films adhere to the paper and become set by loss of heat into the paper immediately upon leaving the printing surfaces, but the temperature of the paper and the temperature and fluidity of the molten ink films on the printing surfaces are such that the print does not attain a solid form before it has flattened out on the surface of the web; that is to say, the paper under these conditions does not chill the ink films so quickly that they remain "picked" or project substantially above the surface of the web. In high speed printing at web speeds of 600 to 1500 linear feet per minute, the time intervals involved are exceedingly minute, so that the ink films printed at A pass almost immediately into contact with the surface of the water-cooled roller **22**, which chills them to a firm or hard, scrape-resistant condition. As seen in Figure 1, roller **22** preferably is arranged so that the paper engages a large part of its surface, thus increasing the efficiency of the chilling action. It will be understood that the print is set by the time it contacts this chilling surface, so that the printed characters are not smeared or marred by passage in contact with roller **22** but instead are improved in their hardness and scrape-resistance.

The actual printing of the second impression on the opposite side of the web takes place in the same manner as the printing of the first impression, the web passing from roller **22** over guide roller **24** and **26** and then through the bite between the printing form and the impression cylinder at B with the unprinted side of the web in contact with the printing form. Throughout the printing operations a finely-divided spray of water-oil emulsion is applied to the second impression cylinder, as previously described. After passage from B the print produced by the second impression is chilled by passage in contact with the surface of the water-cooled roller **28**, and the print of the first impression is preferably rechilled by passage in contact with the water-cooled roller **30**, whereupon the printed web is ready to be folded, cut into sheets and assembled into newspapers.

The following example further illustrates the practice of the present invention: A black thermo-fluid printing ink is provided which contains about 12 parts of carbon black incorporated in about 100 parts of a solid vehicle containing about 30% of Cumar V–2½, about 20% of gilsonite, about 40% of soya bean stearin and about 10% of carnauba wax. Such ink melts in a range of temperatures between about 161° and 166° F. The ink is melted in the ink supply tanks connected with the ink fountains of the press unit and held in readiness for the printing operations.

Heating water at a temperature of about 255° F. is circulated through the printing cylinders 10, and heating water at a temperature of about 235° F. is circulated through the metal inking rollers **18** of the press unit. The press is run idle at a low speed until the printing forms **12** have attained a temperature of at least 215° F. Cold water circulation is established through rollers **22, 28 and 30.**

A supply of water-oil emulsion containing about one part of lubricating oil to about twenty parts of water is provided for the liquid supply pipe **42** connected with the spray nozzles **40.** This emulsion may be prepared by dissolving in water "Solvac" oil, grade "100–M–Special," or soluble oil No. 350, sold by the Socony-Vacuum Company. A supply of air under pressure of about 40–60 pounds per square inch is provided for the air supply pipe **44.** The nozzles **40** are of a type sold by the Binks Manufacturing Company.

With the press unit thus made ready for printing, molten thermo-fluid ink is admitted to the ink fountains and passes therefrom to the inking mechanisms and printing forms of the printing mechanisms; emulsion and compressed air are admitted from pipes **42** and **44**, respectively, to the spray nozzles **40**; and the web W is passed through the printing unit at the desired printing speed. When printing, for example, at a web speed of about 600 linear feet per minute, the water-oil emulsion may be sprayed through the nozzles **40** at a rate of about .5 to 2 gallons per hour per ten inches of width of printing form. The web emerges from the printing unit at a high speed, with both sides of the paper bearing prints of high quality which are hard-non-tacky and rub-resistant. In appearance the print is characterized by a pronounced sharpness and clarity not obtainable with previously known methods of newspaper printing. This appearance is obtained even when using porous newsprint as the paper stock, for the print lies on the surface of the stock and does not penetrate into the matte or show through on the other side. This quality of the printed matter is retained during the subsequent operations by which the printed web is fabricated into sheets and sections.

The new liquid spray treatment disclosed herein can be used not only to protect the print of a first impression during the printing of a second impression on the opposite side of the same web, but also to protect the print on either side of the paper against marring wherever it may be subject to severe abrasion. For example,

parts of the former on high speed newspaper printing presses sometimes engage the print with such pressure that the print tends to be marred or streaked. Such difficulties can be greatly reduced by applying a finely-divided spray of water or water-oil emulsion to one or both sides of the web, from atomizing spray nozzles as aforesaid, just before the web enters the former. This practice seems to keep the printed ink from softening and smudging, and it provides a very thin film of liquid on the print which protects the print against abrasion.

I also find it desirable to provide hollow, perforate angle bars on a high speed printing press when using the present process and to blow air, cooled and saturated with moisture at 70° F. or lower, into these bars and through their perforations during passage of the printed web thereover. This forms an air cushion between the web and each bar which reduces friction on the finished print and minimizes the possibility of scraping solid ink from the web. The moisture in the air reduces static in the paper and helps to keep it from tearing.

Although I have described a particular embodiment of my invention, it will be evident to those skilled in the art that the new features herein disclosed can be utilized to advantage in various ways without restriction to non-essential details of the illustrative embodiment. I therefore desire that the invention be accorded a scope fully commensurate with its novel contributions to the art, as disclosed in the specification and set forth in the appended claims.

I claim:

1. The method of printing normally solid thermo-fluid ink onto both sides of a continuous web of paper or other stock at high printing speeds by means of a rotary letter-press unit including first-side and second side printing mechanisms, which comprises heating the printing forms of both printing mechanisms to elevated temperatures above 210° F., supplying to said forms molten thermo-fluid ink having a viscosity at such elevated temperatures substantially less than the viscosity of ordinary liquid newspaper printing ink, passing the web continuously through said first-side printing mechanism and thereby printing said ink onto the first-side of the web, then continuously chilling the ink films so printed, then passing the web continuously through said second-side printing mechanism and thereby printing said ink onto the second side of the web, then continuously chilling the ink films on said second side, and maintaining a film of liquid on the surface of the impression cylinder of said second-side printing mechanism during the printing operations.

2. In a method of printing, the steps which comprise printing molten films of thermo-fluid ink at elevated temperatures from a heated printing form onto one side of paper or other stock while supporting the other side of the stock against a yieldable impression surface and maintaining a protective film of liquid on said surface next to said other side during the printing operations.

3. In a method of printing, the steps which comprise printing molten films of thermo-fluid ink at elevated temperatures from a heated printing form onto paper or other stock while supporting the other side of the stock against an impression surface and maintaining a thin protective film of volatile liquid on said surface between the same and said other side during the printing operations.

4. A method as described in claim 3, said liquid containing a small proportion of non-volatile lubricant.

5. The method of printing normally solid thermo-fluid ink onto a side of paper or other stock opposite to a side thereof on which films of such ink have previously been printed, which comprises printing molten films of such ink at elevated temperatures from a heated printing form onto said opposite side while supporting the previously-printed side against an impression surface adjacent to the printing form and simultaneously maintaining a film of aqueous lubricating liquid between said impression surface and the previously-printed ink films.

6. A method as described in claim 5, said liquid containing water and a lubricating oil adapted to remain on said surface and prevent said previously-printed films from sticking to said surface upon evaporation of the water.

7. The method of printing with normally solid thermo-fluid ink a side of paper or other stock opposite to a side thereof previously-printed with such ink, which comprises printing molten films of such ink from a heated printing form onto said opposite side while supporting the previously-printed side against an impression surface adjacent to said form and simultaneously maintaining on said surface a liquid film consisting principally of water.

8. A method of printing both sides of a continuous web of paper or other stock with normally solid thermo-fluid ink, which comprises printing molten films of said ink at elevated temperatures onto one side of the web from a heated rotating printing form, then chilling the ink films so printed, then printing molten films of such ink at elevated temperatures onto the other side of the same web from another heated rotating printing form while supporting said one side against a rotating impression cylinder, then chilling the ink films so printed, and applying to said impression cylinder during the printing operations a finely-divided spray of water-oil emulsion.

9. A method of high speed letter-press printing for printing both sides of a continuous web of paper or other stock with normally solid thermo-fluid ink, which comprises continuously feeding the web, at a suitable temperature in a predetermined range substantially below the melting temperature of such ink, to a rotating printing form heated to a temperature above 210° F. and printing molten films of thermo-fluid ink at a viscosity below 10 poises from the printing surfaces of said form onto one side of the web, then continuously contacting the print on said one side with a cool roller to chill the ink films so printed, then continuously passing the web to another, rotating printing form heated to a temperature above 210° F. and printing molten films of such ink from the printing surfaces of said other form onto the other side of the web while supporting the web against the surface of a rotating impression cylinder, thereafter continuously contacting the print on said other side with a cool roller to chill the ink films so printed, and during the printing of said other side applying to said impression cylinder surface a finely-divided spray of volatile liquid containing a small percentage of a non-volatile lubricating agent.

10. A method as described in claim 9, in which said liquid consists of water emulsified with a small percentage of lubricating oil.

11. A method as described in claim 9 and continuously brushing said surface so as to distribute said liquid evenly in a thin film thereon and promote cooling thereof by evaporation.

12. In a rotary printing mechanism for printing normally solid thermo-fluid ink onto paper or other stock, a printing cylinder, an impression cylinder adjacent thereto, means for heating the printing cylinder to elevated temperatures above the melting temperature of the ink to be printed, means for passing the stock between said cylinders, and means in association with said impression cylinder for maintaining a film of liquid on the surface thereof.

13. In a rotary printing mechanism for printing normally solid thermo-fluid ink onto paper or other stock, a printing cylinder, an impression cylinder adjacent thereto, means for heating the printing cylinder to elevated temperatures above the melting temperature of the ink to be printed, means for passing the stock between said cylinders, and means in association with said impression cylinder for maintaining on the surface thereof a film of volatile liquid containing a small proportion of comparatively non-volatile lubricating liquid so as to prevent over-heating of the impression cylinder from heat exchange with the printing cylinder and to maintain a thin protective liquid film between the impression cylinder and the stock.

14. In a rotary printing mechanism for printing molten thermo-fluid ink onto paper or other stock, comprising a printing cylinder, heating means therefor, and an impression cylinder adjacent thereto, spray-forming means for applying a finely-divided spray of liquid to the surface of said impression cylinder and means for supplying liquid to said spray-forming means.

15. In a rotary printing mechanism for printing molten thermo-fluid ink onto paper or other stock, comprising a printing cylinder, heating means therefor, and an impression cylinder adjacent thereto, a roller next to said impression cylinder having a pile surface in contact with the surface of the impression cylinder, and means for continuously applying liquid to the surface of the impression cylinder.

16. In a rotary printing mechanism for printing molten thermo-fluid ink including a printing cylinder adapted to carry a printing form and an impression cylinder adjacent thereto for sustaining the pressure of such form against paper or other stock passing between said cylinders, heating means for said printing cylinder a roller next to said impression cylinder having a pile surface in contact with the surface of the impression cylinder, and spray-forming means arranged to direct a finely-divided spray of liquid onto at least one of the aforesaid surfaces.

17. In a rotary printing mechanism for printing molten thermo-fluid ink including a printing cylinder adapted to carry a printing form and an impression cylinder adjacent thereto for sustaining the pressure of such form against paper or other passing between said cylinders, heating means for said printing cylinder, a roller next to said impression cylinder having a pile surface in contact with the surface of the impression cylinder, a plurality of atomizing spray nozzles arranged in a line substantially parallel to the line of said contact to direct a finely-divided spray of liquid onto at least one of said surfaces, a supply line for liquid connected with said spray nozzles, and a supply line for compressed air connected with said spray nozzles.

18. A rotary printing mechanism for printing molten thermo-fluid ink onto paper or other stock comprising a printing cylinder adapted to carry a printing form, heating means therefor, an impression cylinder adjacent thereto, said impression cylinder having a covering of smooth, finely-woven, heat-resistant fabric and an elastic backing underlying said fabric, a roller next to said impression cylinder having a pile surface in contact with said covering, and spray-forming means for continuously applying a finely-divided liquid spray to said covering.

19. In a rotary printing mechanism including a printing cylinder adapted to carry a printing form and an impression cylinder adjacent thereto for sustaining the pressure of such form against paper or other stock passing between the cylinders, a roller next to said impression cylinder having a pile surface in contact with the surface of the impression cylinder, spray-forming means arranged above said surfaces to direct a finely-divided spray of liquid thereon, and a spray shield depending from a point adjacent said spray-forming means to a point near said roller.

20. In a printing unit comprising a plurality of rotary printing mechanisms for making different imprints of normally solid thermo-fluid ink on the same continuous web, each mechanism including a printing cylinder, an impression cylinder adjacent thereto and means for heating the printing cylinder to elevated temperatures substantially above the melting temperature of the ink to be printed, and means for passing the web continuously between said cylinders of the first mechanism and thereafter between said cylinders of each succeeding mechanism, a liquid-cooled roller beyond said cylinders of each mechanism for contacting and chilling the ink films of each impression immediately after the same have been printed, and means in association with the impression cylinder of each mechanism succeeding said first mechanism for applying a finely-divided spray of liquid to the surface of such impression cylinder.

21. In a letter-press printing unit comprising first and second rotary printing mechanism for printing molten thermo-fluid ink onto opposite sides of a continuous web of paper or other stock, each mechanism comprising a printing cylinder adapted to carry a printing form and an impression cylinder adjacent thereto, means for heating the printing cylinders and the forms thereon to elevated temperatures substantially above the melting temperature of the ink to be printed and means for continuously passing the web between the printing cylinder and the impression cylinder of the first mechanism and then between the cylinders of the second mechanism, means contacting the web beyond the printing cylinder of each mechaism for chilling the ink films just printed on the web, and means in association with the impression cylinder of said second mechanism for preventing overheating of and lubricating the surface thereof to protect the ink films previously printed by said first mechanism, said last-recited means including a roller next to said impresison cylinder having a pile surface in contact with said surface and spray-forming means arranged to direct a finely-divided spray of liquid onto said surfaces.

FRANK G. BREYER.

CERTIFICATE OF CORRECTION.

Patent No. 2,329,152. September 7, 1943.

FRANK G. BREYER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 17, for "the" after "heretofore" read --that--; page 2, first column, line 7, for "theremo-" read -- thermo- --; line 30, for "or" read --of--; line 36, for "ether" read --either--; line 53, for "contracting" read --contacting--; page 4, second column, line 12, for "ot" read --to--; page 7, first column, line 54, claim 16, after "cylinder" insert a comma; line 65, claim 17, after "other" insert --stock--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of November, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)