Aug. 30, 1932. H. J. BILLINGS 1,874,427

ART OF TRANSLUCENT PRINTING

Filed Aug. 30, 1929

Fig. 1

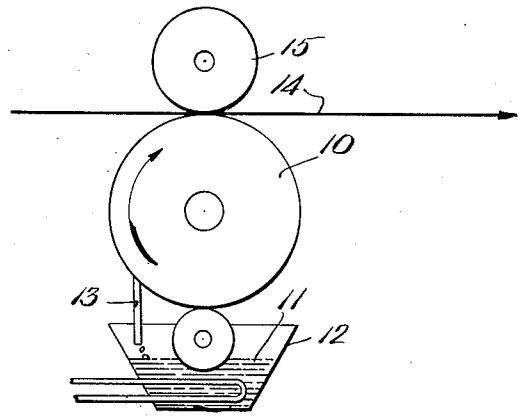
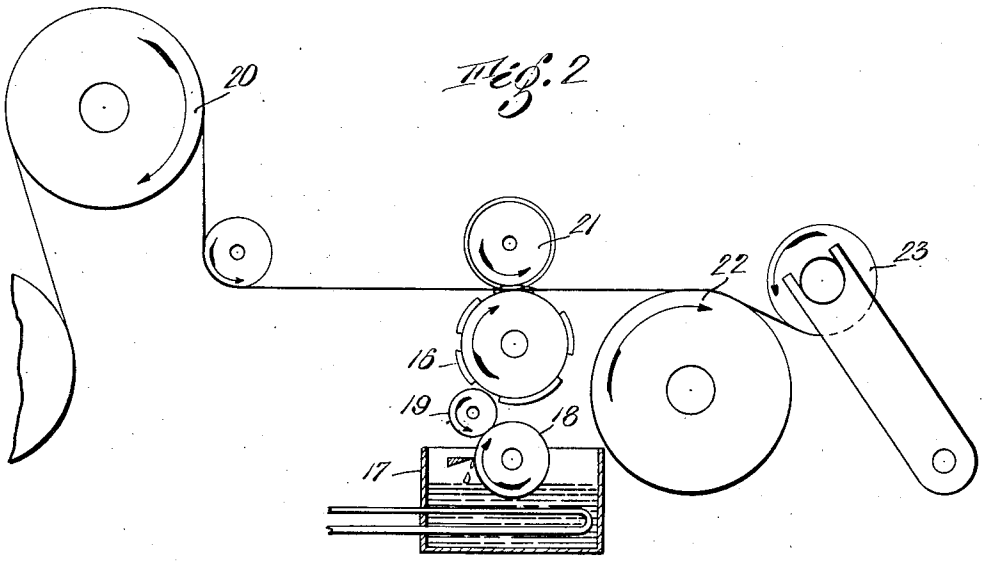


Fig. 2



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UNITED STATES PATENT OFFICE

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ART OF TRANSLUCENT PRINTING

Application filed August 30, 1929. Serial No. 389,434.

This invention relates to the art of printing, and especially to the art of printing translucent imprints upon very thin, absorbent sheets of paper or similar material.

Absorbent materials such, for example, as paper towels, paper napkins, toilet and tissue paper, differ considerably from printing, wrapping, and writing papers as well as other types which have been sized, coated or otherwise rendered relatively non-absorbent, in that they are soft and light, and are extremely absorbent to liquids. The various methods heretofore used in translucent printing and the like, comprising methods involving the use of marking materials which dry by absorption, oxidation, or evaporation of the solvent vehicle, have not been successfully employed for producing a well-defined mark on absorbent materials. Due to the aforesaid characteristics the vehicle or carrier spreads before it has had time to evaporate or set and consequently produces an objectionable blurring.

Paper is commonly manufactured on machines where the paper making, finishing, slitting and rewinding operations are carried on while the stock is traveling at a speed of approximately eight hundred linear feet a minute. In the manufacture of relatively thin absorbent paper it has been found that it is not practical to attempt to trade mark the stock without first considerably slowing down the speed of the machine and hence retarding production. For instance, in watermarking by means of a Dandy roll at relatively high speeds on a stock of a soft, fluffy nature, there is a tendency to foul up the roll and to give considerable operating difficulty from this cause. Moreover, a mark made by an engraved roll in the drier train is not as distinct or as well defined as a true watermark, while embossing after the paper has dried has not been successfully accomplished at speeds of more than four or five hundred feet per minute. The embossing rolls are quite heavy and also present additional mechanical difficulties due partially to the fact that the actual space over which the impression is made frequently occupies so small a proportion of the total area passing through the machine. Furthermore, the embossing operation imparts a harshness to the sheet and also increases the bulk sufficiently to give a roll of larger diameter for the same number of sheets, or quantity of paper, or to require a decrease in the number of sheets or quantity if the diameter is to be maintained in order to have the rolled package fit a standard size container. Printing, on the other hand, can not be done at speeds in excess of approximately four or five hundred linear feet per minute due to the time required for the drying of the inks now available for this purpose. Relatively high speeds preclude the use of oily or resinous fluids which harden the oxidation, or by the evaporation of a solvent, while the porous structure of thin, absorbent sheets so favors the spreading of oily fluids that heretofore it has been impossible to secure sharp outlines by printing.

More specific purposes of this invention are to provide for producing a distinct, well-defined mark upon paper or similar material, and especially upon very thin, absorbent paper, while the latter is traveling at a relatively high rate of speed; to provide for producing such a mark upon paper without appreciably increasing the bulk or imparting objectionable harshness to the sheet; to improve the art of printing, especially upon rapidly moving stock; to provide an improved ink for printing upon rapidly moving stock, and especially upon thin, absorbent sheets; to provide relatively simple and efficient means particularly adapted for embodiment in paper making and finishing apparatus and capable of operating in synchronism therewith even at the maximum operative speeds of such apparatus for printing upon thin absorbent sheets during the manufacture thereof; to provide a very thin absorbent sheet having a sharp, well-defined imprint thereon; and also to provide a very thin, absorbent sheet having a translucent imprint which will not spread when exposed to ordinary temperatures, and which will not offset. If the paper is to be used for toilet paper or other purposes which require it to come in contact with the human body, it is important that the printing fluid should be

free from any injurious ingredients that would cause irritation of the skin or otherwise harm the body.

Apparatus for practicing this invention is shown in the accompanying drawing wherein Fig. 1 is a diagrammatic view of a rotogravure printing apparatus, and

Fig. 2 is a diagrammatic view of raised type printing machine in connection with paper making machinery.

In accordance with the present invention, printing upon sheets moving at a relatively high rate of speed, as for example at eight hundred or more linear feet a minute, is made possible by the use of printing fluid which has the characteristic of drying or solidifying with sufficient rapidity to permit this as well as producing a sharp, well-defined imprint. This printing fluid consists of molten fatty, resinous, or waxy material which congeals at so high a temperature that when paper is printed with the molten material, the latter solidifies at temperatures within the range of room temperatures, i. e. temperatures normally encountered whether in the mill or the machine room where the product is made or in the room where it is ultimately used, and before it has had an opportunity to spread in the sheet, even though the sheet be of very thin, absorbent paper. This printing fluid also has the property of rendering paper translucent and is therefore well adapted for producing a translucent imprint similar to a water-mark even upon very thin sheets of absorbent paper while the latter is traveling at a high rate of speed; and it preferably is free from irritants of the human body.

The materials most suitable to this purpose are those melting well above a temperature of 70° C., since tissue paper for household use frequently may be exposed to the heat of a radiator, which would cause imprints made with lower melting materials to spread. Materials that are particularly suitable are carnauba wax, ceresin, candelilla wax, stearic acid, guaiacum resin, and certain hydrogenated oils, such as hydrogenated sesamum oil, or mixtures of such materials. Relatively small amounts of carnauba wax, in admixture with such materials as paraffin, stearic acid, or ceresin, increase the congelation points of the latter materials very remarkably. Fifteen per cent of carnauba wax, for example, in such a mixture frequently results in a congelation point not very much lower than that of pure carnauba wax. However, if the melting point of the other constituent of the mixture is too low, imprints made with the aid of the molten mixture will spread when exposed to the heat of a radiator, thus defeating the purpose for which the carnauba wax is introduced.

Accordingly, substances which may be used in the present invention may be designated generically as "hard waxes," including by this term the higher members of both the hydrocarbons and fatty acids as well as paraffin, waxes and resins which are of sufficiently high melting point and which are of appropriate fluidity when in the liquid condition, and also mixtures of two or more of these substances. While these "hard waxes" have the property of rendering paper translucent and are therefore particularly suitable for translucent printing, they are not limited in this respect but are useful in printing generally, for the desired color may be obtained by the addition of a soluble dye or other coloring agent or a finely divided pigment. Upon solidifying, the "hard wax" protects the dye and keeps the latter from running, which at present is a serious objection to the use of dyes.

Since the "hard waxes" employed in this process become thinly fluid when melted, and under working conditions closely resemble rotogravure inks in consistency, it is recommended that the printing be performed by the rotogravure process, the speed and other advantages of which are well understood. Moreover the rotogravure process by reason of its speed and other characteristics is well adapted for application to the machines for perforating and slitting the paper, thus making it possible to imprint the paper as it comes through the perforator and slitter and so insuring correct registration and positioning of the imprints upon the sheet, which is very difficult to accomplish by a separate printing machine as an independent operation after the paper leaves the perforator and slitter.

The rotogravure printing apparatus shown in Fig. 1 consists of the cylindrical engraved roll 10, the latter preferably being arranged to dip in the bath 11 of molten "hard wax" in a container 12 corresponding to the ink fountain of the usual rotogravure machine. The surface of the engraved roll 10 rotates in the direction of the arrow and is scraped by the doctor knife 13 before the roll comes in contact with the sheet 14 which is to be printed. The doctor knife removes the molten "hard wax" from all portions of the roll except the engraved pattern to be printed which is below the surface. The sheet of paper 14 passes between the roll 10 and an impression roll 15. The "hard wax" may be maintained in molten condition, preferably at about the consistency of water, by means of suitable heating coils in the bath; and the roll 10 may also be heated if necessary, although the application of heat to the bath in this manner may be sufficient to maintain the proper temperature in the printing roll as well as in the doctor knife which is in contact with the roll.

Fig. 2 illustrates raised type printing apparatus applied to paper making machinery. The printing roll, indicated at 16, is supplied

with the molten hard wax from container 17 (heated by suitable coils) by means of an "ink" roll 18 and a transfer roll 19. The paper passes in the direction of the arrows from the usual paper drier 20, then between the printing roll 16 and the impression roll 21, then over the usual reel 22, which is driven at constant speed, and then the paper is wound up into the finished printed roll 23.

Either raised type printing apparatus or rotogravure printing apparatus may be readily incorporated in paper finishing apparatus so as to assure absolute register with the perforating, slitting and rewinding mechanism. The upper limit of permissible operating speed for the raised type head would be the highest speed at which the molten "hard wax" will adhere to the printing head. This speed would not be greater than approximately five hundred linear feet a minute. It will be clear therefore, that where speeds up to four or five hundred linear feet per minute are required, satisfactory results may be obtained by printing the molten "hard wax" with either the raised type or the rotogravure head, but where higher speeds are required the rotogravure head should be used exclusively.

I claim:

1. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with a hot, molten fluid which has the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within the range of room temperatures.

2. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with a hot, molten fluid containing carnauba wax, which fluid has the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within the range of room temperatures.

3. The method of marking absorbent paper and the like materials, with a translucent imprint simulating a water mark which comprises printing the sheet with a hot, molten fluid which has the capacity for rendering the sheet translucent and which has the property of congealing at so high a temperature as to solidify and form a sharply defined imprint without substantial spreading through the sheet.

4. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with a hot, molten fluid which contains at least 15% of carnauba wax and has the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within the range of room temperatures.

5. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with a hot, molten fluid which has the property of congealing at or above approximately 70° C.

6. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with hot, molten "hard wax" containing at least 15% carnauba wax and having the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within the range of room temperatures.

7. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with hot, molten "hard wax" which has the property of congealing at so high a temperature as to solidify immediately at temperatures within the range of room temperatures.

8. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing by the rotogravure process with hot, molten, "hard wax" which has the property of congealing at so high a temperature as to solidify immediately at temperatures within the range of room temperatures.

9. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with hot, molten "hard wax" and an appropriate coloring agent, the "hard wax" having the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within range of room temperatures.

10. The method of marking absorbent paper and the like materials to produce an imprint thereon simulating a water mark which comprises printing with a hot, molten fluid which is free from irritants of the human body and which has the property of congealing at so high a temperature as to solidify immediately without spreading at temperatures within the range of room temperatures.

11. A sheet of absorbent paper having an imprint thereon simulating a water mark, the imprint comprising a congealed substance impregnated in the paper and confined within well defined outlines and adapted to render the paper translucent, said substance having a congelation point preventative of spreading at temperatures within the range of room temperatures.

12. A sheet of absorbent paper having an imprint thereon simulating a water mark, the imprint comprising a congealed substance free from irritants of the human body impregnated in the paper and confined within well defined outlines and adapted to render the paper translucent, said substance

having a congelation point preventative of spreading at temperatures within the range of room temperatures.

13. A sheet of absorbent paper having a translucent imprint thereon, simulating a water mark, the imprint comprising a congealed substance containing at least 15% of carnauba wax and being impregnated in the paper and confined within well defined outlines and adapted to render the paper translucent.

14. A sheet of absorbent paper having a translucent imprint thereon simulating a water mark, the imprint comprising congealed carnauba wax impregnated in the paper and confined within well defined outlines.

15. A sheet of absorbent paper having a translucent imprint thereon, simulating a water mark, the imprint comprising congealed "hard wax" impregnated in the paper and confined within well defined outlines.

Signed by me at Cambridge, Massachusetts, this 27th day of August, 1929.

HOWARD J. BILLINGS.