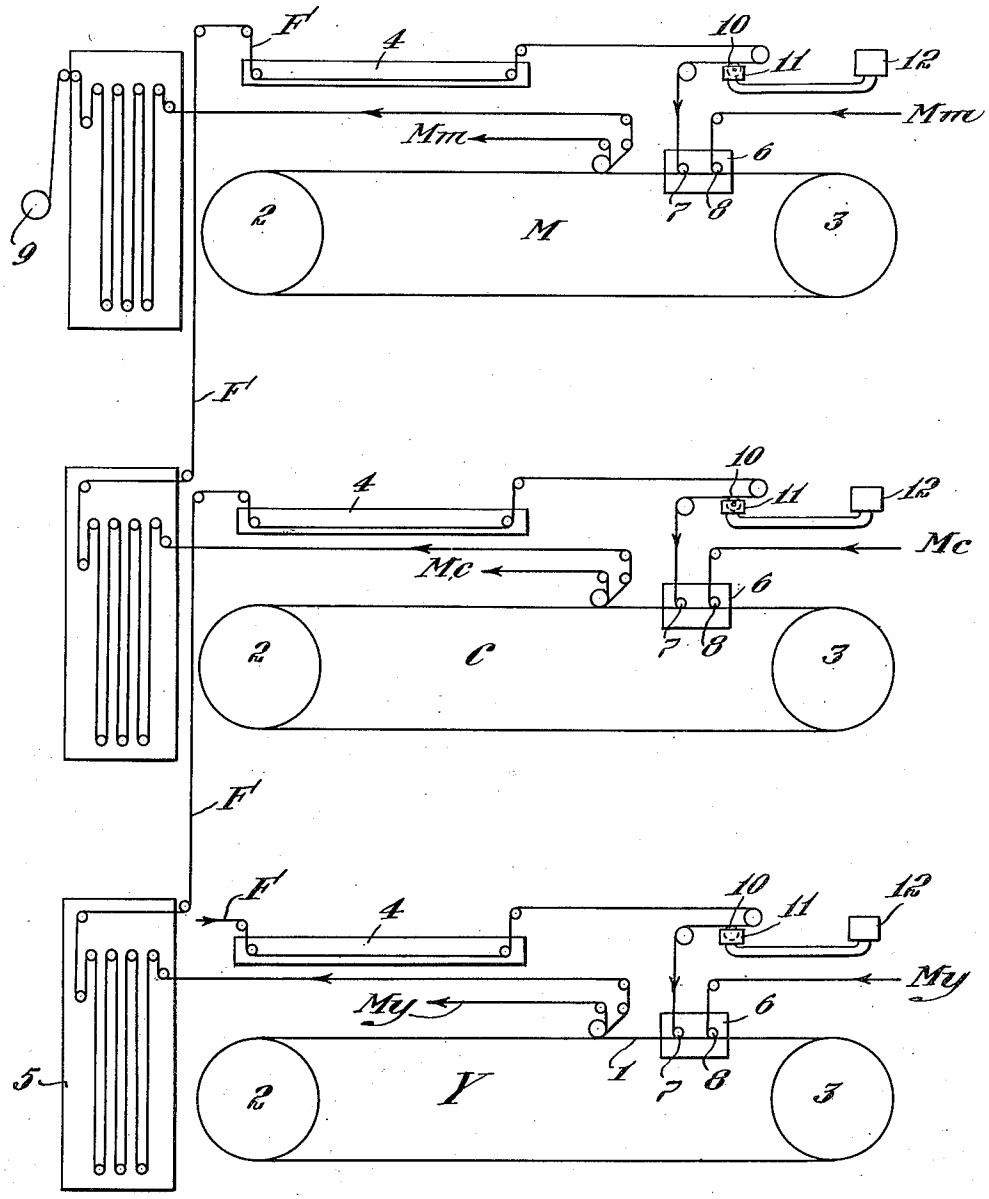
Oct. 23, 1956 A. P. LOFQUIST, JR 2,767,649

METHOD OF PRINTING PICTURES BY IMBIBITION

Filed Feb. 15, 1952



Inventor
Albert P. Lofquist Jr.
by Roberts, Cushman & Groves
Att'ys.

United States Patent Office

2,767,649

Patented Oct. 23, 1956

1

2,767,649

METHOD OF PRINTING PICTURES BY IMBIBITION

Albert P. Lofquist, Jr., North Hollywood, Calif., assignor to Technicolor Motion Picture Corporation, Hollywood, Calif., a corporation of Maine

Application February 15, 1952, Serial No. 271,723

2 Claims. (Cl. 101—149.1)

In printing pictures by imbibition on a dye-absorptive film from a relief matrix soaked with dye much difficulty has been encountered in getting good dye transfer from matrix to film in certain areas of the relief matrix, particularly at the foot of a shoulder between thick and thin areas of the relief and more particularly in a valley between two adjacent shoulders. This difficulty is particularly troublesome in heavy-density and high-relief areas, that is in shadow areas where the gelatin (or other relief material) is thick and the thickness varies widely so that the valleys are comparatively deep. While the difficulty is encountered to some extent with each of the three colors customarily employed in imbibition printing (yellow, cyan and magenta) it is particularly troublesome when printing with magenta. Due to the aforesaid difficulty it has been necessary to scrap a substantial proportion of all three-color film printed by imbibition.

Objects of the present invention are to overcome the aforesaid difficulty, to eliminate the loss of film due to poor transfer adjacent hills in the matrix relief, to increase the rate of dye transfer, thereby permitting increase in the speed of the transfer machine, and to improve the definition of the imbibition prints by permitting the use of film having harder dye-absorptive material.

According to the present invention an aqueous solution of an alkali metal sulphate is applied to the surface of the film before the matrix and film are pressed together. While any alkali metal sulphate, including ammonium sulphate, may be employed, sodium sulphate is recommended. The pH value of the solution should be approximately 6.5 to 7.5 and this is preferably accomplished by neutralizing and/or acidifying the solution with sulphuric acid. The concentration of the solution should be at least a few tenths of one percent but less than saturation. Best results are obtained by applying the solution to the face of the film within a few seconds before the matrix and film are pressed together.

While any suitable dye-absorptive material may be used in making the film and matrix, gelatin-coated strips of cellulose acetate or cellulose nitrate are recommended. The matrix reliefs may be etched in any suitable way, the gelatin on the film to be printed may be prehardened as desired, and any suitable transfer apparatus may be employed. Suitable methods and apparatus are disclosed in the issued patents of Technicolor Motion Picture Corporation, particularly 2,437,361 and 2,448,691.

For the purpose of illustration a typical embodiment of the invention is illustrated in the accompanying drawing in which the figure is a diagrammatic representation of a three-stage imbibition cinematographic machine in which yellow dye is transferred from the matrix *My* to a film F in the first stage M, cyan dye is transferred from the matrix *Mc* to the film in the second stage C and magenta dye is transferred from the matrix *Mm* to the film F in the third stage M.

Each of the three stages comprises a pin belt **1** on which the film and the matrix are registered while dye is imbibed by the film from the matrix, the belt traveling

2

over two rollers or drums **2** and **3**. Before the matrices are fed into contact with the film they are each soaked in the appropriate dye. Before the film is fed into contact with the matrix it is soaked for a short time in a water bath **4** to render it more dye-absorptive, and after each dye transfer the film is dried in a dry box **5**. Each matrix is fed into contact with the film in a water tank **6** to avoid occlusion of air bubbles between the two films, the pin belt feeding into and out of each tank **6** through water traps which minimize the escape of water. The film F is seated on the pin belt by a roller **7** and each matrix is seated on the film by a roller **8**, the roller being spring-pressed as disclosed in Patent 2,437,361 to press the film and matrix into intimate contact. Thus the film feeds through a water tank **4**, thence to the first pin belt **1**, thence to the first dry box **5**, thence to the second stage C, thence to the third stage M and thence to the take-up reel **9**.

According to the present invention the aforesaid solution is applied to that face of the film F which is to receive dye from the matrices by means of a roller **10** dipping into a pool **11** in which the solution is kept at the proper level from a suitable receiver **12**. If the sulphate solution is applied to the film immediately before the film and matrix are rolled together, there is no harm in applying an excess of solution, particularly if the film passes through a water bath after the coating is applied and before the film contacts the matrix; the excess is rinsed off by the water bath and without the bath it would be squeezed off by the pressure roller which rolls the film and matrix together. However, the coating should be sufficient to form, throughout the entire width of the zone to be printed, a continuous adsorbed film of sulphate solution. While the concentration of the solution and the thickness of the coating may be varied widely, for 35 mm. color motion film best results have been obtained with a 250 g./l. solution applied 0.3 cc. per foot of film at a film speed of 200 feet per minute.

The aforesaid treatment of the film affords remarkable results in that it substantially eliminates the loss of film due to poor dye transfer adjacent hills in the relief, it increases the rate of dye transfer, thereby permitting increase in the speed of the transfer machine, and it permits the use of film having harder dye-absorptive material, thereby improving the definition of the printed pictures.

While the reasons for these remarkable results are not fully understood it is though that the sulphate ion is the important factor, possibly acting as a catalyst. The increased rate of dye transfer is believed to be at least partly the result of a change in surface tension. A definite change in the surface condition in the treated film is evidenced by comparative friction or slippage tests, that is sliding the film over the matrix; a sulphate-treated film slides freely over a matrix whereas an untreated film tends to stick. This slippage phenomenon probably results in more intimate contact between the film and matrix by permitting the film to smooth out while the matrix and film are being brought together under the pressure roller. Comparative thickness measurements indicate that the sulphate treatment slightly shrinks the blank emulsion. This may be the reason why better results are obtained by applying the sulphate immediately before bringing the film and matrix into contact with each other; if the shrinkage takes place in the early part of the transfer period it may afford improved contact by reducing the pressure between film and matrix. Also the shrinkage may expel some of the water from the swollen gelatin before the film and matrix are brought together, thereby facilitating dye transfer, particularly in high-relief heavy-density areas. The sulphate may also lower the osmotic pressure in the aqueous solution on the film surface and/or lower the vapor pressure by its reaction.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. The method of printing pictures by imbibition on a dye-absorptive film which comprises forming a relief matrix of dye-absorptive material, absorbing dye into the matrix, applying to the surface of the film an aqueous solution of an alkali metal sulphate, and bringing said matrix and film together while the film is wet with said solution, the concentration of the solution being at least a few tenths of one percent but less than saturation.

2. The method of printing pictures by imbibition on a dye-absorptive film which comprises forming a relief matrix of dye-absorptive material, absorbing dye into the

matrix, applying to the surface of the film an aqueous solution of a sodium sulphate, and bringing said matrix and film together while the film is wet with said solution, the concentration of the solution being at least a few tenths of one percent but less than saturation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,121,187	Ives	Dec. 15, 1914
1,517,200	Donisthorpe	Nov. 25, 1924
1,939,219	Mees	Dec. 12, 1933
2,054,261	Lierg	Sept. 15, 1936
2,059,887	Mannes et al.	Nov. 3, 1936
2,176,585	Evans	Oct. 17, 1939
2,446,193	Rich	Aug. 3, 1948