July 31, 1934. R. S. BRACEWELL 1,968,279

APPARATUS FOR DECORATING WEBS OF MATERIAL SUCH AS PAPER, CLOTH, AND THE LIKE

Filed April 10, 1930 2 Sheets-Sheet 1

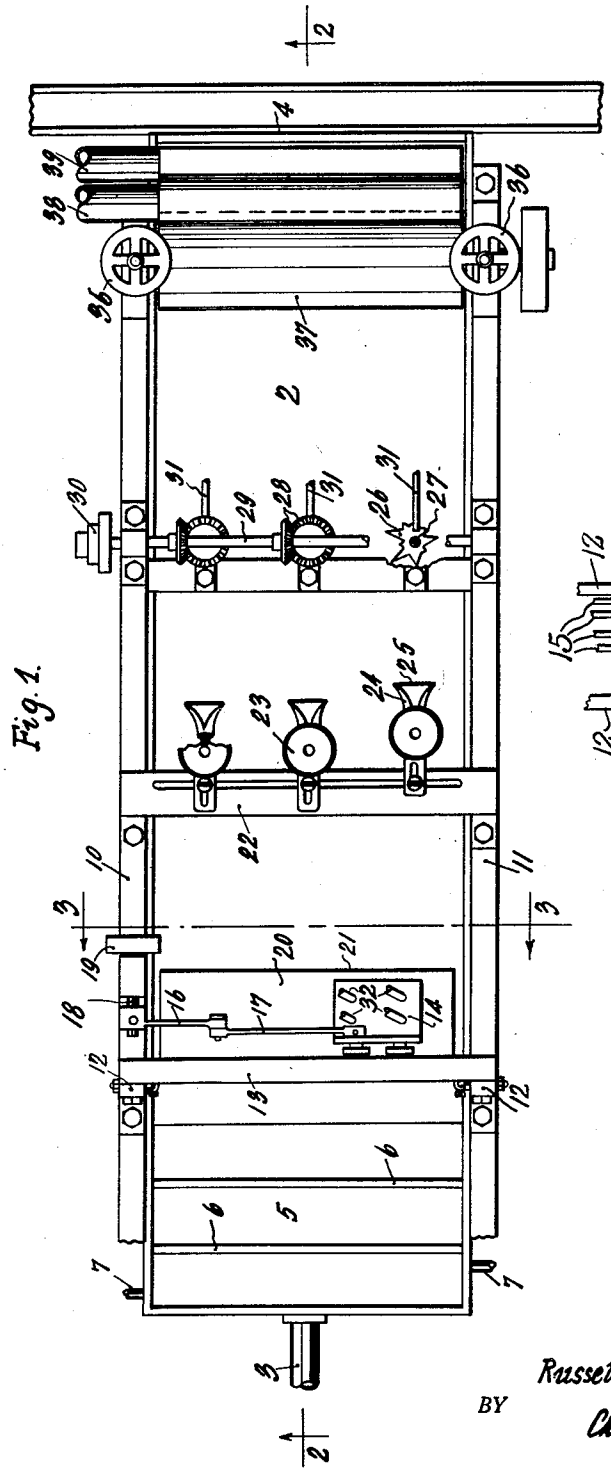


Fig. 1.

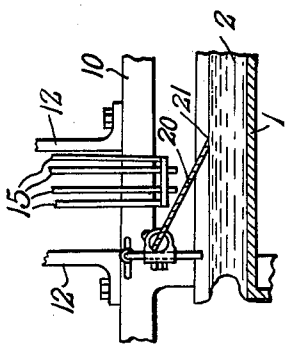


Fig. 6.

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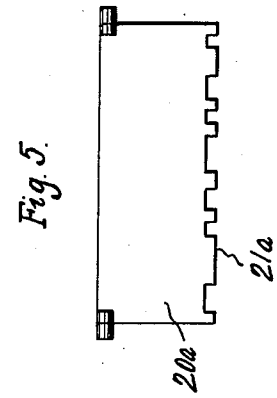


Fig. 5.

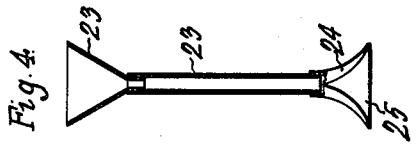


Fig. 4.

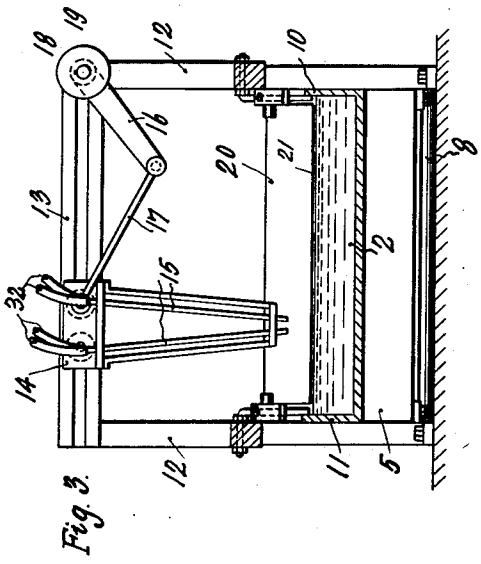


Fig. 3.

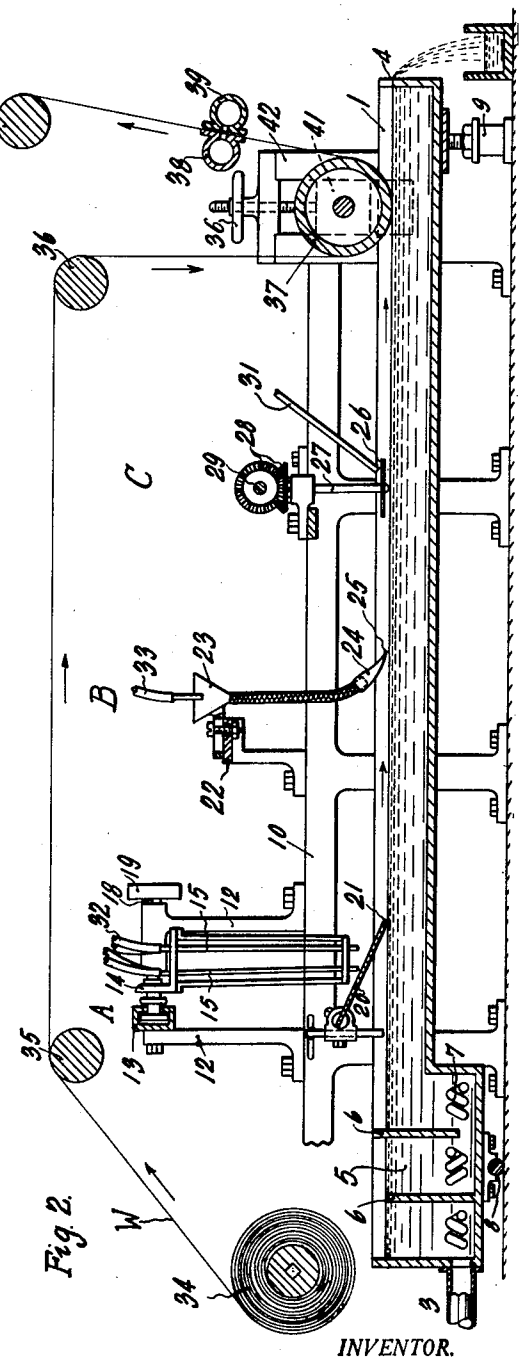


Fig. 2.

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Patented July 31, 1934 1,968,279

UNITED STATES PATENT OFFICE

1,968,279

APPARATUS FOR DECORATING WEBS OF MATERIAL SUCH AS PAPER, CLOTH, AND THE LIKE

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Application April 10, 1930, Serial No. 443,192

19 Claims. (Cl. 91—9)

This invention is a continuation in part of my previous application filed August 10, 1928, Serial No. 298,768, and in part a continuation of my previous application filed April 23, 1929, Serial No. 357,530.

The present invention relates to a process and apparatus for imparting a variegated design to webs of materials such as paper, cloth and the like in a manner somewhat analogous to that of marbling, wherein a mutable design of color is floated on the surface of a liquid carrier and is taken off the same by the web of material.

The object of the invention is the provision of improved means and methods for the formation and control of the color design on the carrier and its subsequent transfer to the web whereby both beautiful and unique decorative effects may be obtained at relatively low cost. While the mutable design floated on the carrier will never be precisely the same in detail, yet sufficient control thereof may be had under the present improvement to reproduce in its general aspect and appearance any of the particular designs capable of being made.

For the decoration of paper and other similar smooth and dense materials, satisfactory results are attained by the application of the color thereto as a coating, while for the decoration of cloth and the like it is desirable for the best effects to impregnate the fabric with the color in such manner as to actually dye the goods; and the present improvement in apparatus and method readily adapts itself to either manner of application. The improved process may be carried on continuously in the deposit of color and formation of the design on the liquid carrier and for its transfer to a traveling web; whereby said material may be let off a roll, run through the present apparatus to receive its color decoration, subsequently treated by finishing operations, and finally wound up on a take up roll, all of which contributes to a high rate of production at low cost.

In its broad aspects, the present process consists in employing a carrier body of water, preferably a gravity flowing stream in a trough, the stream moving slowly enough to maintain its upper surface perfectly smooth and unrippled, and in preparing a color fluid having physical properties which enable it to float on the carrier and with little or no diffusion thereof into the water, then gently laying on the surface of the carrier the color fluid so that it will float thereon undisturbed; and before said floating color design loses its identification by mixing appreciably with the water of the carrier, lapping the same off on the surface of the web. For this lapping action, the web is brought barely into touching contact with the carrier surface while moving in the same direction and approximately at the same speed therewith. There may be a very slight difference in speed between the contacting surfaces of the web and water carrier in the transfer of the color design to the web, such differences in speed acting to modify the design somewhat as it is taken up. But when the speed between the contacting surfaces is the same, the color design will be transferred to the web substantially unchanged from its character on the carrier.

After the transfer of the color to the web, any excess water lapped off with the color may be removed by subjecting the surface of the web to an air blower or suction device. In the case of a paper web, it is found preferable to blow a stream of air against its wetted side; and in the case of cloth web and such more porous material, it is preferable to apply a suction at the back or unwetted side of the web. In the latter case, the suction will not only withdraw some of the excess moisture from the web but will also pull the color into the fibers of the fabric in facilitating the dyeing thereof. In some cases, it may also be desirable to subject the web to the combined action of a blower on one side and a suction device at the other side thereof.

With regard to certain particular features of the process, attention should be given to the laying of the color fluids on the water carrier so as to minimize all possible disturbance of its surface and to prevent the sinking of the colors below the surface. Some color fluids will be more easily floated and less readily diffused into the water carrier than others. For paper decoration, oil colors, non-soluble in water, are generally used and such colors present little difficulty as to flotation or diffusion in a water carrier; whereas the colors suitable for decorating cloth are usually water soluble dyes and these generally require to be mixed with other components to give them the necessary physical property of being easily floatable and not easily diffusible in the water carrier. Moreover, I have found that after an initial color fluid has been successfully deposited and floated on the carrier surface, less difficulty is encountered in depositing subsequent color fluids on top of the first with respect to the tendency to sink or diffuse in the water carrier.

In the carrying out of the process for the obtaining of the variegated design, separate color depositing stations are located at different points

from the upstream to the downstream portion of the carrier, and any suitable or desired color may be deposited at each station. The web surface contact with the carrier for the transfer of the design of course takes place downstream slightly beyond where the design is completely formed on the moving carrier. This space distance may be varied as desired for obtaining different effects in the mutable design before transfer to the web.

For the deposit of the initial color at an upstream point of the carrier, and more particularly when this color is of the water soluble character, I prefer to lay on the color very gently in the form of a thin film and with this object in view flow the color slowly down an inclined surface or baffle to a point closely adjacent, or at, the surface of the carrier, whereby it flows on the carrier without splashing or any serious disturbance of the carrier surface. The action is one of gradually merging the under surface of the color film into flowing conjunction with the upper surface of the water carrier. The rate of flow of the color film to its union with the carrier may be regulated by suitable adjustments in the inclination of the baffle so that the color film will meet the flowing carrier surface while moving at about the same speed as said carrier and thus join with the latter quietly and smoothly.

In some cases, a film or stream of color as wide as the carrier stream may flow off the baffle onto the carrier and thus constitute a ground color for a subsequently formed variegated design; in other cases, separate streams or films of color will flow from the baffle to the carrier and subsequently spread out on the carrier by the action of surface tension. It may also be desirable to conduct streams of several different colors (different in hue) for flowing down the baffle and to cause by mechanical control a greater or less degree of coalescence between said different color streams on the baffle before their flow off onto the carrier. These and other modifications in the carrying out of the process may be resorted to as desired in the obtaining of various decorative effects.

The laying on or deposit of subsequent colors downstream of the initial depositing station may be accomplished in a manner similar to that described for the initial color; but whereas in the deposit of the initial color the inclined baffle may have its lower edge just touching or slightly above the water carrier surface, the baffles for subsequent depositing stations should preferably just clear the water surface so as to allow the colors previously deposited to flow past and beneath the same undisturbed. Any desired number of different color depositing stations may be employed, some for laying on individual color streams as a wide or narrow film, others for throwing color in drops, by a spattering action. As previously stated, however, any spattering deposit of water soluble colors should preferably be made on top of color previously deposited on the water carrier.

Referring to the drawings, which show in somewhat diagrammatic form a suitable apparatus for carrying out my process:

Fig. 1 is a plan view of the apparatus;

Fig. 2 is a view in longitudinal section of the tank showing some of the apparatus in side elevation;

Fig. 3 is a transverse section along line 3—3 of Fig. 1 and showing in front elevation the initial depositing station;

Fig. 4 is a detached detail view of one of the color depositors;

Fig. 5 is a detached detail in plan of a modified form of baffle; and

Fig. 6 is a view showing an alternative position of the baffle.

In said drawings, 1 indicates a tank or trough for containing a body of liquid such as water, constituting the water carrier 2. A water inlet for said tank is indicated at 3 and an outlet therefor at 4.

The inlet end of the tank 1 is preferably formed somewhat deeper than the remainder thereof to provide a settling chamber 5 for sediment, and wiers or partitions 6 are mounted therein to quiet the flow of water. Also cooling pipes 7, carrying a coolant, are extended into said chamber 5 to maintain the water of the carrier at the proper low temperature for avoiding the formation of air bubbles in said water carrier. The objection to air bubbles is that they come to the surface of the carrier and may undesirably modify the color design thereon. The inlet end of the tank 1 is also mounted on a fulcrum 8 and the outlet end is supported by an adjustable stand 9, whereby the tilt of said tank may be regulated for the proper gravity flow of the water carrier. The upper surface of said water carrier flows smoothly and unrippled in the direction of the arrow from one end of the tank to the other. 10 and 11 indicate side rails of a frame which borders the sides of said tank and upon which are mounted various other parts of the apparatus.

At an upstream portion of said tank, indicated at station A, there is mounted an initial color depositor. As shown in Fig. 3, this arrangement comprises a frame standard 12 having a transversely extending guide rail 13 upon which is mounted for reciprocating movement a supporting frame 14 for a plurality of color conduits 15. A crank 16 and pitman 17, driven from shaft 18 and pulley 19, are arranged as shown for reciprocating the frame 14 back and forth along the rail 13. The color conduits 15 (four in number, as shown) are carried in the frame 14 and terminate just above an inclined baffle plate 20. The baffle 20 extends clear across the tank and is mounted (as shown) so as to be adjustable both longitudinally and vertically of the tank 1 and also so that its inclination with respect to the water surface may be adjusted. Preferably the baffle is mounted at such an inclination to the water surface that color flowing therefrom will meet the water surface going at about the same rate of travel as said water surface. The lower edge 21 of said baffle 20 is sharpened and is located to just clear the upper surface of the water carrier 2, or said edge 21 may at this initial station be so positioned as to just touch the surface of the water carrier, see Fig. 6.

It will be understood that each of the separate conduits 15 may conduct a color fluid of the same or a different hue and that said color fluid, by the reciprocation of said frame 14, is deposited first upon the baffle 20 and then flows off said baffle as a film onto the surface of the water carrier 2. When colors of different hue are simultaneously deposited on the baffle 20 from the several conduits 15 during a back and forth movement thereof across said baffle, the different films thus formed more or less coalesce and blend with one another into a film of variegated design which flows off the baffle 20 onto the water carrier surface. The inclined baffle 20 may either have a straight lower edge 21, as shown in Fig. 3, or may

be constructed as shown in Fig. 5, wherein the baffle plate 20*a* is provided with serrated lower edge 21*a*. This irregular formation of the lower edge of the baffle tends to break up the film formed thereon into irregular streams for flowing onto the surface of the water carrier.

At locations downstream from the initial color depositing station just described, there may be mounted various other color depositors, of the same or different type. At station B there is mounted a transverse supporting rail 22 which carries a plurality of color depositors 23 which are alike in construction and each of which is mounted for adjustment transversely and to a limited extent fore and aft on said rail 22. These depositors 23 preferably comprise a funnel shaped receiving end from which extends a flexible pipe 23 which may be fixedly adjusted into various positions. The lower end of the flexible pipe carries a discharge mouth 24 which is widened into a flat blade 25, the lower end of which is closely adjacent to but slightly clearing the upper surface of the water carrier 2.

At the station C, further down the stream, is mounted a plurality of color depositors of the same general character as shown in previous Patent 1,742,250, Jan. 7, 1930, granted to me as a joint inventor with others. Each of these depositors comprises an irregular star-shaped disk 26 mounted on a vertical and rotating shaft 27, the several shafts 27 of said disks being driven through bevel gearing 28, horizontal shaft 29 and pulley 30. Conduits 31 lead down to the upper surfaces of said disks 26 for bringing the color thereto from a color supply reservoir. Also flexible tubes 32 and 33 are provided for bringing color from suitable sources of supply to the color depositors at stations A and B.

The web of material to be decorated, such as paper or cloth, is indicated at W and is caused to travel from suitable driving means (not shown) in the direction of the arrow from let-off roll 34, over guide rolls 35, 36 to an adjustable guiding drum 37, which brings said web into contact with the upper surface of the water carrier 2. Thereafter said web passes across a suction device 38 and a blowing device 39, then around guide roll 40 and off to other parts of the apparatus for being finished.

The web guide member or drum 37 is preferably mounted on the frame of the apparatus so that it may be adjustable vertically with respect to the surface of the water carrier 2. As shown, the drum is carried in slide blocks 41 vertically movable in a frame 42 and may be raised and lowered by hand wheel 36. It will be understood that similar supporting means for the guide drum 37 are mounted at each side of said main frame, so that the proper horizontal adjustment of said guide drum 37 may be maintained.

In the guiding of paper into contact with the water carrier 2, it may be desirable to rotate the guide drum 37 so as to have a surface speed equal to that of the travel of the paper and the travel of the moving water carrier. But in the case of cloth, the guide drum 37 need not be rotated as the cloth may be pulled around the smooth surface of the same as a stationary guiding member. In either case, however, the travel of the paper or cloth into contact with the upper surface of the water carrier should be approximately the same in speed as the travel of said water carrier.

The air blowing device, indicated at 39, may be employed during the use of the apparatus in decorating paper web, and acts similarly to that described in the before mentioned Patent 1,742,250. The suction device 38 at the opposite side of the web is more preferably employed in the treatment of cloth as it will cause a better penetration of the color into the cloth than the blowing device, and moreover its position is removed from the freshly imparted design. It will be understood also that the blowing device 39 does not actually rub the front surface of the web but is slightly spaced therefrom. In the treatment of either cloth or paper, it may sometimes be desirable to operate both the suction device 38 and blowing device 39 to act in conjunction,—this and other slight changes in the described operation being a matter of choice in the obtaining of desired results.

What I claim is:

1. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, the lower edge of said baffle being closely adjacent to said carrier surface, means for conducting color to said baffle to flow down the same on to said carrier surface for being floated therein, said color conducting means comprising a color conduit and a traversing frame for directing the deposit of said color back and forth across said baffle, and means for guiding a traveling web of material into lapping contact with said carrier surface to take off the color design therefrom.

2. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, the lower edge of said baffle being closely adjacent to said carrier surface, means for conducting color to said baffle to flow down the same on to said carrier surface for being floated thereon, said color conducting means comprising a plurality of color conduits for separate colors and a traversing frame for directing the deposit of said colors therefrom back and forth across said baffle, and means for guiding a traveling web of material into lapping contact with said carrier surface to take off the color design therefrom.

3. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, the lower edge of said baffle being closely adjacent to said carrier surface, means for conducting color to said baffle to flow down the same on to said carrier surface for being floated thereon, said color conducting means comprising a plurality of color conduits for separate colors and a traversing frame for directing the deposit of said colors therefrom back and forth across said baffle, one or more color depositors located above said carrier surface, each comprising a color conduit leading to an inclined blade, the lower edge of which is closely adjacent said liquid carrier surface, one or more color depositors each comprising a rotating irregularly pointed star shaped disk located above said carrier surface, a conduit for conducting color to the upper surface of said disk, and means for guiding a traveling web of material into lapping contact with said carrier surface to take off the color design therefrom.

4. A device for decorating paper comprising a tank carrying a body of water, a roll positioned

to guide a paper web into contact with the surface of the water, means for applying a preformed continuous film of color to the water surface, and means for distributing discontinuous drops of color on said continuous surface.

5. A device for decorating paper comprising a tank carrying a body of water, a roll positioned to guide a paper web into contact with the surface of the water, means for applying a preformed continuous film of variegated color to the water surface, and means for distributing discontinuous drops of color upon the continuous film to further variegate it and interrupt its appearance of continuity.

6. A device for decorating paper comprising a tank carrying a body of water, a roll positioned to guide a paper web into contact with the surface of the water, an inclined baffle, means for distributing color upon the baffle above the water surface so that the color may flow down the baffle and form a continuous film upon the water surface, and means for distributing discontinuous drops of color on said continuous film.

7. A device for decorating paper comprising a tank carrying a body of water, a roll positioned to guide a paper web into contact with the surface of the water, an inclined baffle, means for distributing color upon the baffle about the water surface so that the color may flow down the baffle and form a continuous film upon the water surface, at least one rotating disk positioned between the baffle and the roll, and means for delivering color to the surface of such disk whereby it will be discharged in the form of drops upon said continuous film.

8. In an apparatus for imparting a mutable design of color to a web of material wherein said design is floated on a liquid carrier, at least one color depositor located above said carrier surface comprising an inclined blade, the lower edge of which is closely adjacent said liquid carrier surface and an adjustable color conduit leading to said blade, at least one color depositor located above said carrier surface comprising a rotatable irregularly pointed, star shaped disk and a color conduit leading to the upper surface of said disk, and means for guiding a traveling web of material into lapping contact with said carrier surface to transfer the color deposited thereon by said depositors to the web.

9. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, the lower edge of said baffle being closely adjacent to the carrier surface, means for conducting color to said baffle to flow down the same onto the carrier surface to be floated thereon, at least one color depositor for applying additional color to the carrier surface comprising an inclined blade, located above the carrier surface with its lower edge closely adjacent the surface of the carrier, and a color conduit leading to said blade, and at least one color depositor for applying additional color to the carrier surface comprising a rotating irregularly pointed, star shaped disk located above the carrier surface and a conduit for conducting color to the upper surface of the disk, and means for guiding a traveling web of material into lapping contact with the carrier surface to transfer the color deposited thereon by said baffle and depositors to the web.

10. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, means for conducting color to said baffle plate to flow down the same and form a film thereon, said baffle plate being so inclined and having its lower edge in sufficiently close proximity to the surface of the carrier so that the color film formed on the baffle plate flows with unbroken continuity onto the surface of the liquid carrier, and means for guiding a traveling web of material into lapping contact with said carrier surface to take off the color design therefrom.

11. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, means for conducting color to said baffle plate to flow down the same and form a film thereon, said baffle plate being so inclined and having its lower edge in sufficiently close proximity to the surface of the carrier so that the color film formed on the baffle plate flows with unbroken continuity onto the surface of the liquid carrier, adjustable supporting means for said baffle plate whereby its inclination to and its distance from said carrier surface may be varied, and means for guiding a travelling web of material into lapping contact with said carrier surface to take off the color design therefrom.

12. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, a baffle plate mounted at an inclination to the surface of said carrier, the lower edge of said baffle being serrated, means for conducting color to said baffle plate to flow down the same and form a film thereon, said baffle plate being so inclined and having its lower edge in sufficiently close proximity to the surface of the carrier so that the color film formed on the baffle plate flows with unbroken continuity onto the surface of the liquid carrier, and means for guiding a travelling web of material into lapping contact with said carrier surface to take off the color design therefrom.

13. In an apparatus for imparting a mutable design of color to a web of material wherein said color design is floated on a liquid carrier, at least one color depositor located above said carrier surface, comprising an inclined blade and a color conduit leading thereto for the formation of a color film on the blade, said blade being so inclined and having its lower edge in sufficiently close proximity to the surface of the carrier so that the color film formed on the blade flows with unbroken continuity onto the surface of the liquid carrier, and means for guiding a travelling web of material into lapping contact with said carrier surface to take off the color design therefrom.

14. A machine for decorating paper by the flotation method which comprises a water-containing trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, and means for depositing color upon the slanting surface of said member above the water level.

15. A machine for decorating paper by the flotation method which comprises a water-containing trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, and means for depositing a plurality of colors in predetermined relation upon the slanting surface of said member above the water level.

16. A machine for decorating paper by the flotation method which comprises a water-con-

taining trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, a plurality of color distributing devices, and means for moving said devices back and forth across the slanting surface of said member above the water level.

17. A machine for decorating paper by the flotation method which comprises a water-containing trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, a plurality of pipes each delivering a separate stream of color, and means for moving the pipes simultaneously back and forth across the slanting surface of said member to deliver the color streams thereupon above the water level.

18. A machine for decorating paper by the flotation method which comprises a water-containing trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, an oscillatable frame above said member, a plurality of pipes each delivering a separate stream of color, and means for oscillating the frame to carry the pipes back and forth across the slanting surface of said member to deliver the color streams thereupon above the water level.

19. A machine for decorating paper by the flotation method which comprises a water-containing trough, a member having a slanting surface contacting at its lower edge with the water and extending transversely of the trough, a plurality of pipes each delivering a separate stream of color, means for moving the pipes back and forth across the slanting surface of said member to deliver the color streams thereupon above the water level.

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