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APPARATUS AND METHOD FOR DECORATING SHEET MATERIALS

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3 Sheets-Sheet 1

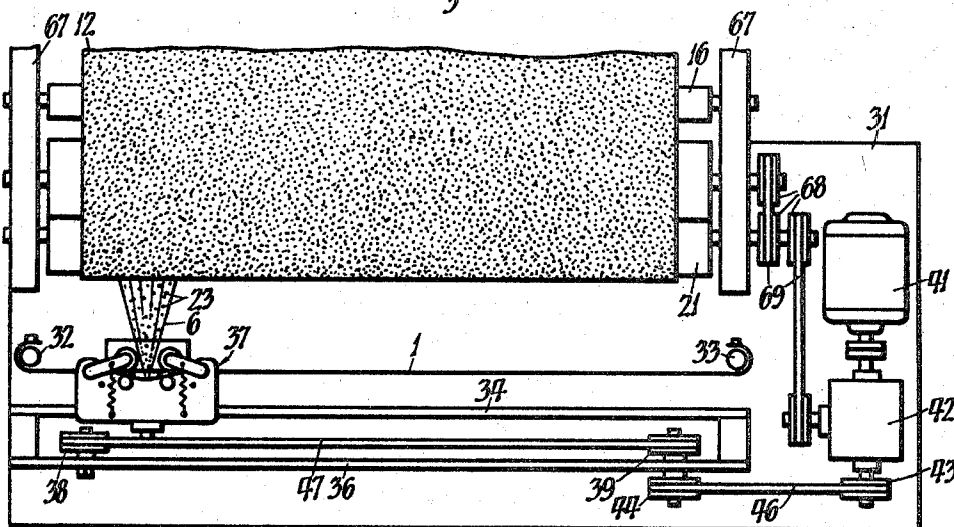
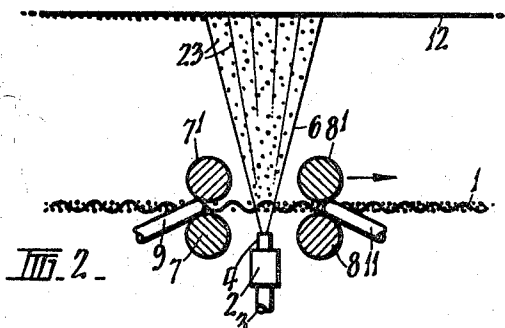
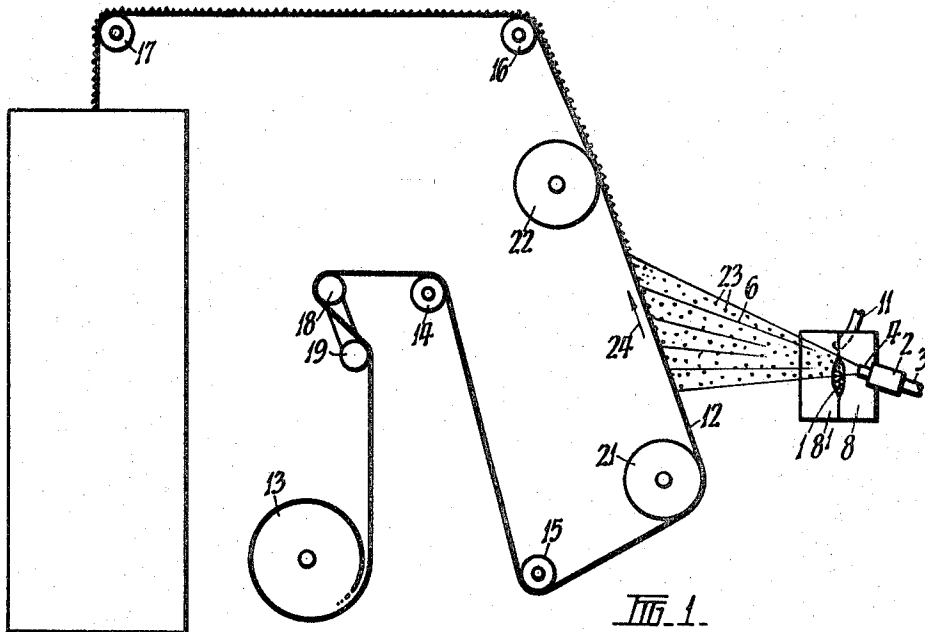


FIG. 3

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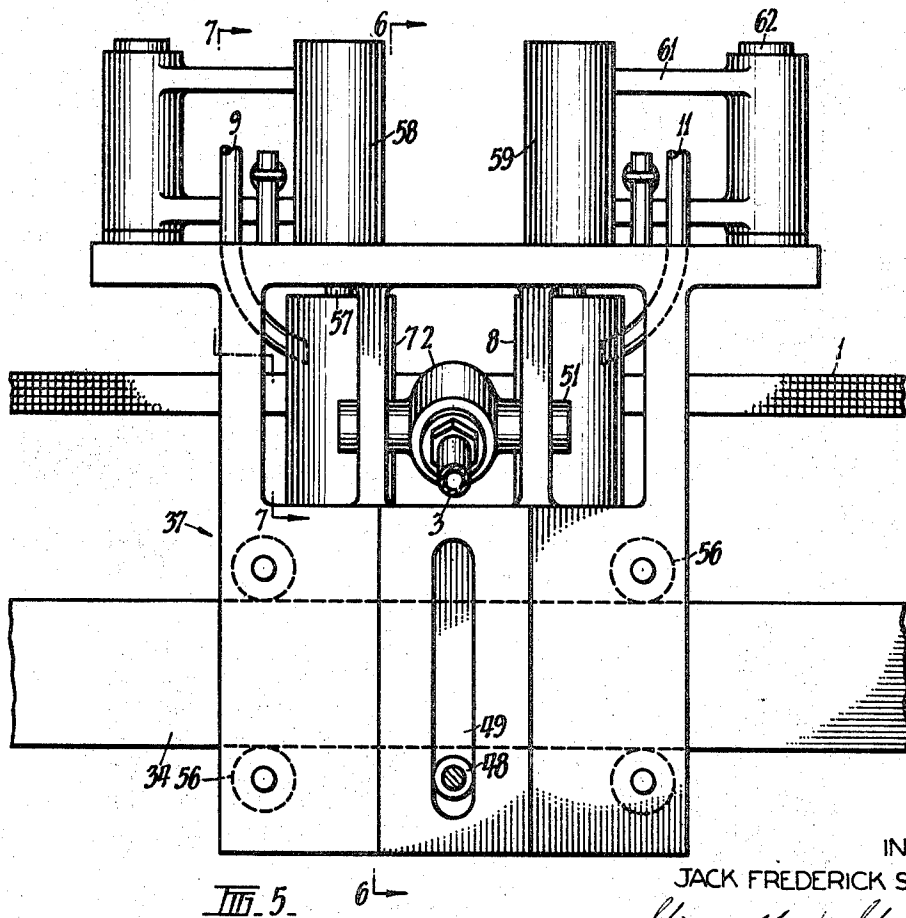
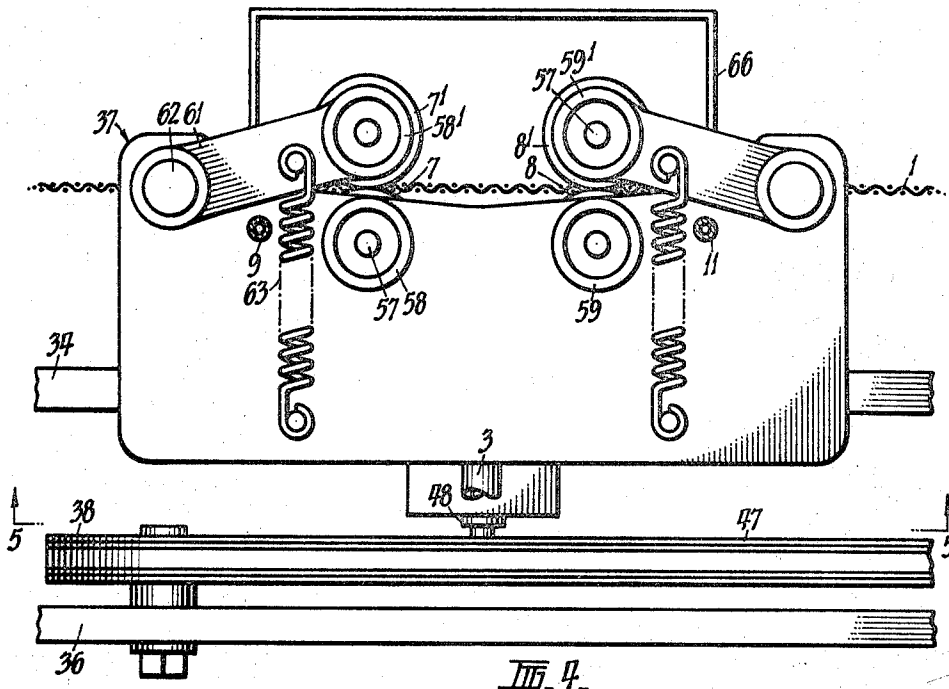
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3 Sheets-Sheet 2



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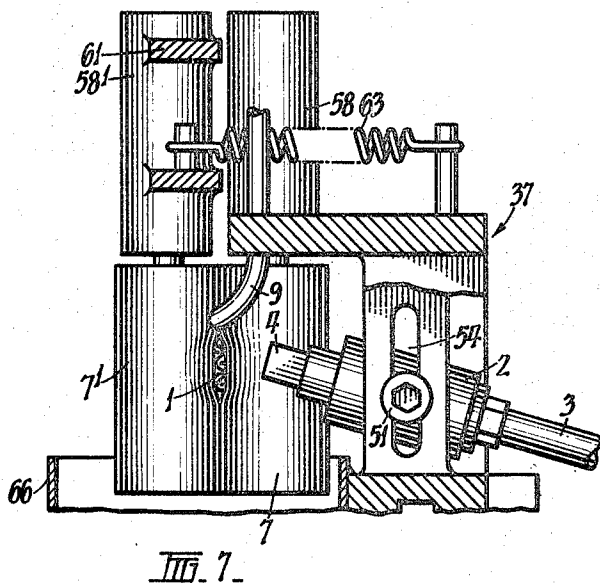
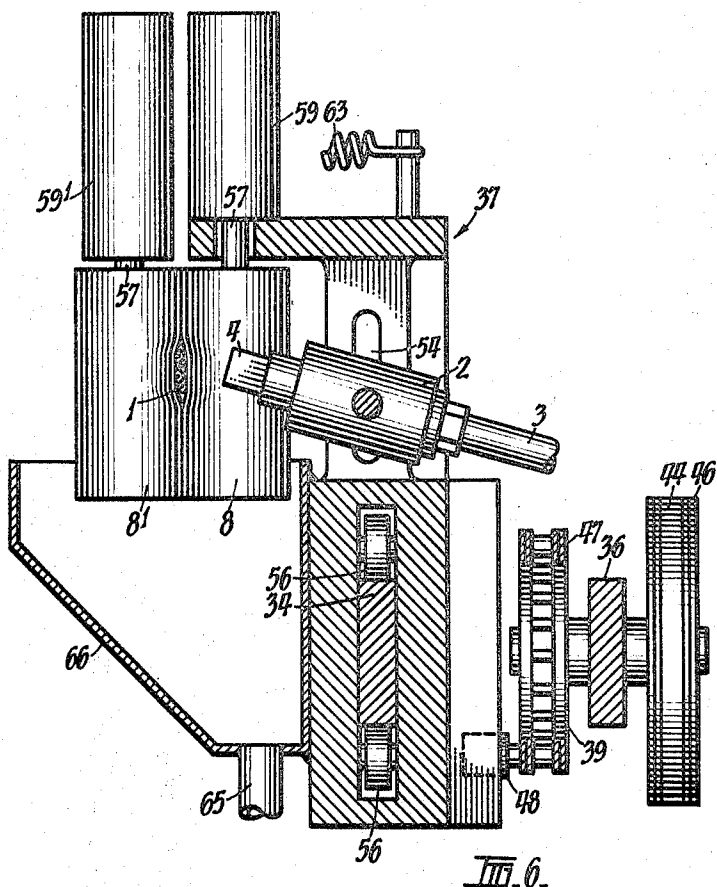
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APPARATUS AND METHOD FOR DECORATING SHEET MATERIALS

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3 Sheets-Sheet 3



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APPARATUS AND METHOD FOR DECORATING SHEET MATERIALS

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16 Claims

ABSTRACT OF THE DISCLOSURE

Decorating sheet material, particularly cloth, by applying a dye or the like to a ribbon-like band of metal mesh so that the dye is retained in the mesh and displacing the dye from the mesh onto a sheet material by means of an air jet which reciprocally traverses the band along its length.

This invention relates to an improved apparatus and method for decorating sheet materials. More particularly the invention is concerned with an apparatus and a method for applying a liquid colour medium, as hereinafter defined, such as a dye solution or paste or a pigment in liquid suspension to any form of sheet material, such as, for example, paper, textiles, metal and wood, to produce a variety of mottled stippled and similar effects, which can be easily controlled.

The term "colour medium" will be understood to include not only any suitable dye solution or paste or pigment suspension, but also such substances as dye intermediates and coupling reagents, bleaching agents and the like.

According to the present invention there is provided a method of decorating sheet materials comprising applying a liquid colour medium, as hereinbefore defined, to a surface having a series of apertures therein so that the medium is supported in the apertures, directing a forceful gas stream at at least a portion of said surface to displace the medium from at least some of the apertures in the form of droplets suspended in the gas stream, and placing a sheet of material to be decorated adjacent said surface and in the path of the gas stream containing the suspended droplets, whereby the droplets are deposited on the sheet.

The present invention also provides apparatus for decorating sheet materials comprising a surface having a series of spaced apertures therein, means for applying a colour medium to said surface so as to be supported in the said apertures, means for directing a forceful gas stream against at least a portion of said surface and through at least some of the said apertures in sequence and means for passing a sheet of material to be decorated through the said gas stream adjacent said surface.

The shape of the gas stream will depend on the manner in which it is produced but, in general, it will be conical or pyramidal. However, it will be realised that portions of the gas stream adjacent the axis will carry more colour medium than portions adjacent the edges and thus that the colour medium may not be evenly deposited. Where this is not desired the problem can be overcome to an extent by using multiple gas streams, however, as it is difficult to control the degree of overlap of the gas streams where they impinge on the sheet and to position the gas streams so that they only overlap an extent sufficient that the colour medium is evenly deposited, the use of multiple gas streams does not provide an entirely satisfactory solution. The inventor has found, however, that the problem of uneven distribution

can be substantially overcome by the use of a gas stream which is directed at a portion of said surface and which is moved over said surface to displace the medium from other portions of said surface. In a particular aspect of this, one dimension of the gas stream where it impinges on said surface is substantially less than the corresponding dimension of said surface and means are provided for reciprocally traversing the gas stream over said surface in the direction of said corresponding dimension.

In one particularly preferred aspect of this invention said means for passing the sheet into the gas stream moves the sheet, in a plane substantially parallel to said direction and in a path transverse to said direction, a distance substantially less than, preferably $\frac{1}{8}$ or less of, the width of the gas stream where it impinges on the sheet, measured along said path, for one transverse of the sheet by the gas stream. It is preferred that the sheet is moved intermittently and that it is only moved when the gas stream has completed one traverse of the sheet but before commencing the next traverse of the sheet. If desired, however, the sheet may be moved substantially continuously along said path whilst the gas stream is traversing although it is to be noted that in this instance the colour medium may be deposited on the sheet in discrete strips unless the speed of movement of the sheet or the speed at which the gas stream traverses is carefully controlled.

Conveniently said means for applying colour medium comprises one or more pairs of pinch rollers disposed with said surface between the nip or nips of the rollers and said rollers and said surface move relative to one another and means for delivering colour medium to one or more of the rollers or to said surface. In one particularly suitable arrangement the gas stream is directed at said surface by means of a nozzle, it may be in the form of a slit and of variable size, which is carried by a carriage which also carries the pinch rollers and which carriage reciprocally traverses said surface in said direction.

It is preferred that said surface is a stationary surface and that it is a band which is substantially longer than it is wide and that the band is disposed with its length horizontal and its width in a vertical plane.

However, the surface can be a moving surface and in one instance of this the surface is a conveyor surface, such as an endless belt or a disc which can rotate, and the means for applying the colour medium comprises a container for the liquid colour medium through which the conveyor surface passes. However, in this instance the rate of decorating depends upon the rate of conveyor surface movement and it is found that irregular curtains of colour medium are picked up by the conveyor surface and/or that fly-off or colour medium from the conveyor surface occurs when the conveyor surface is passed through the container in excess of a certain speed. The inventor has found that this problem can be substantially overcome by passing the conveyor surface through the nip or nips of one or more pairs of pinch rollers subsequent to passing through the container. Alternatively, the container may be dispensed with and the conveyor surface passed through the nip or nips of one or more pairs of pinch rollers after having colour medium applied thereto or the colour medium may be applied to one or more of the pinch rollers.

Certain of the apertures in said surface may be prevented from allowing the passage of the gas stream or may be prevented from supporting the medium within themselves so that a particular pattern may be achieved. The apertures may be distributed uniformly or in a predetermined pattern over said surface.

The pattern of the droplets being deposited on the sheet can readily be controlled and varied by varying the

amount and the viscosity of the colour medium applied to said surface, by passing the sheet of material through the path of the gas stream containing the suspended droplets at varying speeds and by varying the velocity of the gas stream and the speed at which the gas stream moves over said surface.

One preferred embodiment of the apparatus of the invention and its method of operation will now be described with the aid of the accompanying drawings in which:

FIG. 1 is a schematic elevation of the apparatus,

FIG. 2 is a schematic plan of the apparatus,

FIG. 3 is a plan view of part of the apparatus,

FIG. 4 is a plan view of part of the apparatus, shown in FIG. 3,

FIG. 5 is a sectional view taken along the line 5—5 in FIG. 4,

FIG. 6 is a sectional view taken approximately along the line 6—6 in FIG. 5, and

FIG. 7 is a sectional view taken along the line 7—7 in FIG. 5.

The apparatus will firstly be described schematically with reference to FIGS. 1 and 2 and then the constructional details shown in FIGS. 3 to 7 will be explained. The apparatus as shown in FIGS. 1 and 2 comprises a band 1 of metal mesh, formed of 30 wire gauge stainless steel wire having 24 meshes to the inch, which is $\frac{1}{2}$ " wide and which has its width disposed in a vertical plane and its length in a horizontal plane. The band 1 is secured, at each end, under tension.

An air manifold 2 supplied by an air blower (not shown) via an air pipe 3 has a nozzle 4 having a vertical slit $\frac{1}{4}$ " by $\frac{1}{8}$ ". The slit is disposed on one side of the band 1 and $\frac{3}{4}$ " therefrom so as to direct a high velocity air jet 6 towards the band. The air manifold 2 is mounted to reciprocally move from one end of the band to the other so as to play the jet 6 over the band.

Two pairs of rubber pinch rollers, 7 and 7¹ and 8 and 8¹, are mounted to reciprocally move from one end of the band 1 to the other and are disposed so that the air jet 6 passes unimpeded between the two pairs of pinch rollers. The band 1 is disposed between the two pairs of pinch rollers and in consequence of the engagement with the band the rollers are caused to rotate as they reciprocally move over the length of the band.

Two feed tubes, 9 and 11, supply a colour medium to the two pairs of rollers and, in consequence of the reciprocation and rotation of the pinch rollers, the colour medium is applied to the band and is retained in the mesh of the band. By adjustment of the pressure exerted on the band by the rollers, the quantity of colour medium retained in the mesh of the band may be adjusted.

A sheet of cloth 12 to be decorated is transported and guided from supply roll 13 by guide rollers 14, 15, 16 and 17, tensioning rollers 18 and 19 and drive rollers 21 and 22. The drive roller 22 is of slightly larger diameter than the drive roller 21 to ensure that the portion of the cloth between rollers 21 and 22 is in tension. The drive rollers 21 and 22 served to run the sheet about 12" from the band 1 on the opposite of the band to the air jet 6.

When the apparatus is in use, the colour medium is fed to the reciprocating pinch rollers 7 and 8 at a controlled rate and is applied to the band by the pinch rollers and retained in the mesh of the band 1.

As the air jet 6 passes through the mesh, the colour medium in the mesh is displaced therefrom in the form of a spray of droplets 23. This spray then impinges on the sheet 12 and covers an area of 12" in the vertical plane and 6" in the horizontal plane. When the air jet has completed a traverse of the band, the sheet 12 is advanced 2" in the direction of the arrow 24 and thus it will be realised that 6 coats of colour medium are applied to each 2" wide strip of the cloth.

Reference will now be had to FIGS. 3 to 7 to aid in the description of the construction of the apparatus.

The band 1 is supported between pegs 32 and 33 which project upwardly from the base 31 and which are rotatable to adjust the tension of the band.

Two rails 34 and 36 are mounted on the base 1 and carry, respectively, a carriage 37 and sprockets 38 and 39. Sprocket 38 is an idler sprocket and sprocket 39 is driven by motor 41 through gearbox 42, sprockets 43 and 44 and endless roller chain 46 and around the sprockets 38 and 39 runs another endless roller chain 47. One of the pins in the chain 47 passes through a roller 48 which is vertically slidable in a slot 49 in the carriage so that motion of the chain 47 can be converted into reciprocating motion of the carriage 37 along the rail 34.

The carriage 37 carries the nozzle 4 and air manifold 2 which are mounted for vertical and angular movement by means of bolts 51 which are provided with nuts 52 and washers 53 and which pass through slots 54 in the carriage 37.

The carriage 37 is also provided with guide rollers 56 which serve to guide the carriage as it moves along the rail 34.

The two pairs of pinch rollers 7, 7¹; 8, 8¹ are mounted on the carriage and run on shafts 57 which extend into bearing races 58 and 58¹ and 59 and 59¹. The bearing races 58 and 59 are rigidly fixed to the carriage and the races 58¹ and 59¹ are rigidly supported by yokes 61 mounted for angular movement about posts 62. The races 58¹ and 59¹ are urged towards the races 58 and 59 by means of springs 63 and hence the rollers 7¹ and 8¹ are urged towards rollers 7 and 8 respectively.

The colour medium feed tubes 9 and 11 are mounted on the carriage 37 and a drip container 66 is mounted below the pinch rollers.

The drip container 66 is connected to a colour medium reservoir (not shown) via tube 65 by means of a pump (not shown) actuable by microswitches (also not shown) at each end of the rail 34 which, in turn, are actuable by the carriage 37 when it reaches the ends of the rail 34. The colour medium reservoir is connected to the feed tubes 9 and 11 to feed colour medium thereto by gravity.

The transporting and guiding rollers are mounted on supports 67 and the drive rollers 21 and 22 are driven by sprockets 68 and chains 69 from the gearbox in the intermittent manner previously described.

By varying the pressure exerted on the band by the pinch rollers, the distance the sheet material is advanced for each traverse of the band by the air jet, the viscosity of the colour medium and the velocity of the air jet, a variety of mottled, stippled and other decorative effects can be produced on the sheet material.

Further, by adjusting the position of the air jet in the vertical plane relative to the band, all or part of the colour medium in the band may be displaced by the air jet. By varying the angular disposition of the nozzle relative to the sheet the angle of impingement of the spray may be varied and in this respect it should be noted that it is preferred that the axis of the spray is not 90° to the sheet as at such an angle there is a tendency for eddy currents to form at the edges of the spray which produce uneven coating of the sheet. It should also be noted that by use of several such arrangements a machine capable of applying multi-coloured patterns could be produced.

It is further contemplated to place the width of the band in the horizontal plane and to direct the jet vertically downwards through the band.

It is to be understood that other modifications and adaptations may be made to the construction above described without departing from the spirit and scope of this invention which includes every novel feature and combination of features herein disclosed.

I claim:

1. A method of decorating sheet material comprising the steps of applying a liquid colour medium to a stationary surface having a series of apertures therein which

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support the colour medium, displacing the colour medium from at least some of the apertures by directing a forceful gas stream at a portion of said surface, reciprocally traversing said gas stream over said surface so that it is directed at other portions of said surface and displaces the colour medium from other of the said apertures in sequence so that the colour medium is suspended in the form of droplets in the gas stream and placing a sheet of material to be decorated adjacent said surface and in the path of the gas stream containing the suspended droplets of the colour medium.

2. A method according to claim 1, wherein the dimension of the gas stream in the direction of traverse of said gas stream where it impinges on said surface is substantially less than the corresponding dimension of the surface.

3. A method according to claim 2, wherein the sheet is moved in a plane substantially parallel to said direction of traverse of said gas stream in a path transverse to said direction and wherein said dimension of the gas stream where it impinges on the sheet measured along said path is substantially in excess of the distance moved by the sheet along said path for one traverse of said surface and hence of the sheet by the gas stream.

4. A method according to claim 2, wherein said surface is a stationary band which is substantially longer than it is wide and is disposed with its length horizontal and its width in a vertical plane.

5. Apparatus for decorating sheet materials comprising a stationary surface having a series of spaced apertures therein which are adapted to support a liquid colour medium, means for applying a colour medium to said surface, means for directing a forceful gas stream against a portion of said surface and through some of the said apertures in sequence, means for reciprocally traversing said gas stream over said surface so that it is directed against other portions of said surface and through other of the said apertures in sequence and means for passing a sheet of material to be decorated into the gas stream adjacent said surface.

6. Apparatus according to claim 5 wherein said surface is a stationary band which is substantially longer than it is wide and is disposed with its length horizontal and its width in a vertical plane.

7. Apparatus for decorating sheet materials comprising a stationary surface having a series of spaced apertures therein which are adapted to support a liquid colour medium, means for directing a forceful gas stream against at least a portion of said surface and through at least some of said apertures in sequence, and means for reciprocally traversing the gas stream over said surface, the dimension in the direction of traverse of said gas stream where it impinges on said surface being substantially less than the corresponding dimension of the surface, and means for passing a sheet of material to be decorated into the gas stream adjacent said surface.

8. Apparatus for decorating sheet materials according to claim 7, wherein said means for passing the sheet into the gas stream moves the sheet, in a plane substantially parallel to said direction and in a path transverse to said direction, a distance substantially less than said dimension of the gas stream where it impinges on the sheet, measured along said path, for one traverse of the surface and hence of the sheet by the gas stream.

9. Apparatus according to claim 8, wherein said means

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for passing the sheet into the gas stream maintains the sheet substantially stationary while the gas stream is traversing said surface.

10. Apparatus according to claim 8, wherein said means for passing the sheet into the gas stream moves the sheet substantially continuously in said direction while the gas stream is traversing said surface.

11. Apparatus according to claim 7 wherein the gas stream is directed at said surface by means of a nozzle which reciprocally traverses said surface in said direction.

12. Apparatus for decorating sheet materials comprising a surface having a series of spaced apertures therein which are adapted to support a liquid colour medium, means for applying a colour medium to said surface, means for directing a forceful gas stream against at least a portion of said surface and through at least some of the said apertures in sequence and means for passing a sheet of material to be decorated into the gas stream adjacent said surface, wherein said means for applying colour medium comprises at least one pair of pinch rollers disposed with said surface between the nip of the rollers and wherein said rollers and said surface move relative to one another and means for delivering a colour medium to be distributed by said rollers over said surface.

13. Apparatus for decorating sheet materials comprising a surface having a series of spaced apertures therein which are adapted to support a liquid colour medium, means for directing a forceful gas stream against at least a portion of said surface and through at least some of said apertures in sequence, one dimension of said gas stream where it impinges on said surface being substantially less than the corresponding dimension of said surface, means for reciprocally traversing the gas stream over said surface in the direction of said corresponding dimension and means for passing a sheet of material to be decorated into the gas stream adjacent said surface, wherein said means for applying colour medium comprises at least one pair of pinch rollers disposed with said surface between the nip of the rollers and wherein said rollers reciprocally move over said surface in said direction and means for delivering a color medium to be distributed by said rollers over said surface.

14. Apparatus according to claim 13 wherein said means for delivering colour medium delivers colour medium to at least one of the pinch rollers.

15. Apparatus according to claim 13, wherein said means for delivering colour medium delivers colour medium to said surface.

16. Apparatus according to claim 13, wherein the gas stream is directed at the band by means of a nozzle which reciprocally traverses said surface in said direction and the pinch rollers and nozzle are mounted on a carriage.

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U.S. Cl. X.R.

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