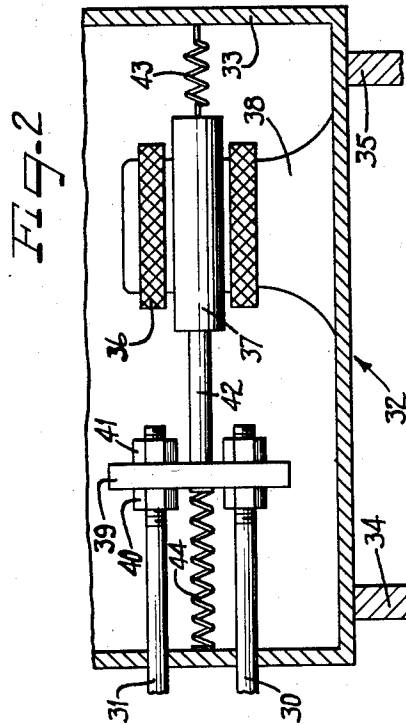
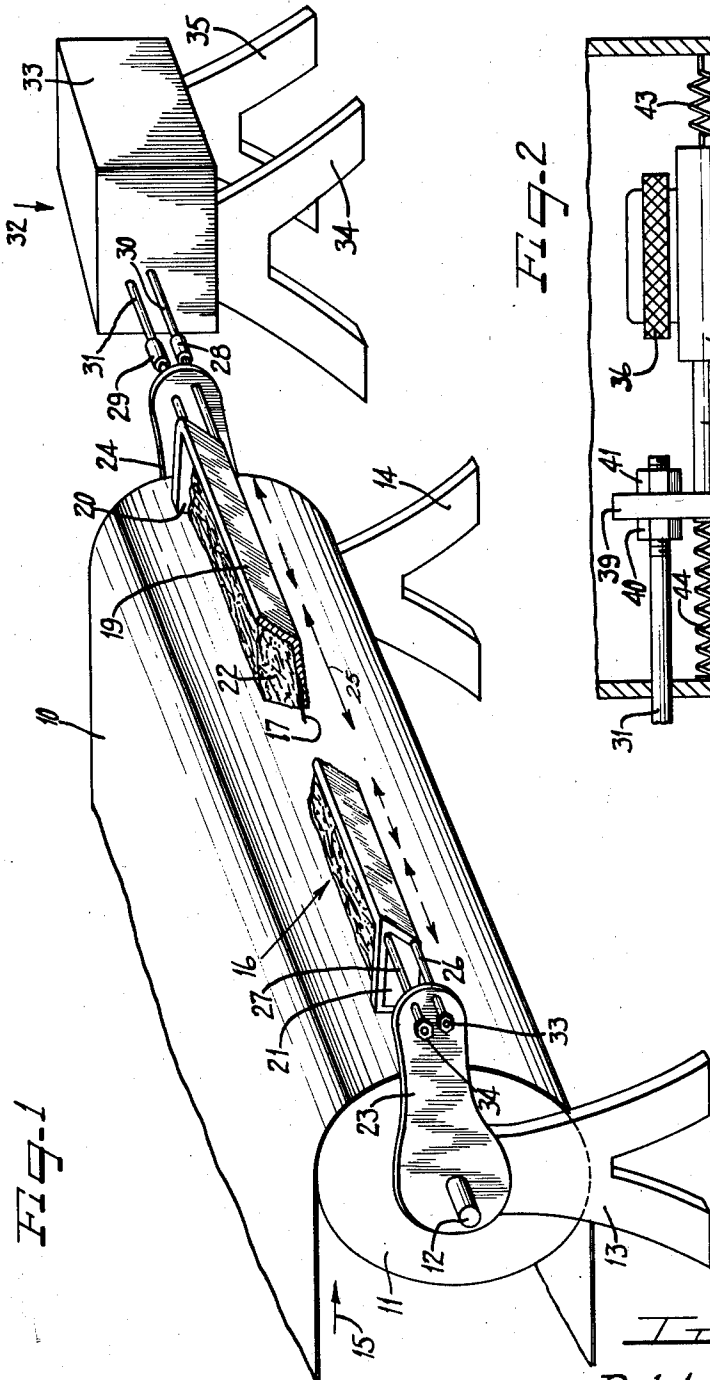


Nov. 27, 1962

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COATING MACHINE AND METHOD USING A VIBRATING
FOUNTAIN WITH DOCTOR
Filed Dec. 22, 1958

3,066,047



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COATING MACHINE AND METHOD USING A VIBRATING FOUNTAIN WITH DOCTOR

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Filed Dec. 22, 1958, Ser. No. 782,080

7 Claims. (Cl. 117-120)

This invention relates to a method and apparatus for coating sheet materials. More particularly, this invention relates to such a method and apparatus particularly adapted for use in the coating of paper or similar flexible sheet materials and affords improved control of the quantity of coating material applied and of the quality of the resulting coating.

In the paper making and other analogous arts, it is frequently necessary to coat a web or sheet of flexible material such as paper with a fluid solution containing solid matter sometimes in suspension for coloring or finishing purposes. Various types of apparatus have in the past been devised for this purpose. In one typical type of apparatus, a rotating drum carries an endless web of paper and a so-called "doctor blade" extends across the paper surface to smooth and knead coating onto the paper surface with the coating being applied at or ahead of the blade depending upon the particular arrangement employed. In any arrangement, the doctor blade is necessarily positioned in relatively close contact with the coated surface in order to achieve its intended function. Of course, the closer this contact the more excess coating material will be wiped from the surface. It has been found that in such apparatus, hard solid particles from the coating substance tend to accumulate under the blade thereby causing streaks and scratches in the coated surface. That is to say, the surface of the doctor blade tends to become covered with a layer of partially dried coatings from which grit particles may become loosened and result in streaks and scratches on the coated surface.

It is therefore an object of this invention to provide a method and apparatus for coating sheet materials which overcomes the above-noted difficulties.

It is a further object of this invention to provide a method and apparatus for transverse vibratory control of a coating applicator.

It is a further object of this invention to provide a method and apparatus affording improved control of the quantity of coating material delivered by a trailing blade coater.

Other objects, features, and advantages of the present invention will be more fully apparent to those skilled in the art from the following detailed description taken in connection with the accompanying drawing in which like reference characters refer to like parts throughout and wherein.

FIGURE 1 is a perspective view partly diagrammatic showing one form of apparatus suitable for carrying out the method of the present invention, with the doctor blade structure of the invention being partly broken away.

FIGURE 2 is a cross-sectional view partly in elevation and partly diagrammatic showing the details of the vibrator shown in FIGURE 1.

Turning now to the drawings, there is shown in FIGURE 1 a simplified and partially diagrammatic perspective view illustrating the essential features of apparatus for coating a web or sheet of paper 10 in accordance with the present invention. This apparatus comprises a back-up roll 11 over which the web or sheet of paper or other flexible material is trained. Conveniently, the back-up roll 11 may have a rubber covering on its external cylindrical surface. The roll 11 is mounted on a

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longitudinally extending axial shaft 12 which may be journaled in any conventional manner in supporting members 13 and 14 and may be driven or rotated by any conventional drive means not shown. The intended direction of rotation of the roll 11 as shown in FIGURE 1 is clockwise so that the paper 10 moves in the direction of the arrow 15.

Pivotaly mounted adjacent in close running relation to the surface of the roll 11 is a doctor blade assembly 16 which, in FIGURE 1, is shown partially broken away to illustrate the interior details thereof. The doctor assembly comprises a doctor blade 17 mounted on the bottom member 18 of the generally trough-like doctor assembly 16. The doctor assembly 16 is also provided with a front wall 19 and end dam members 20 and 21. It will thus be seen that when the doctor assembly 16 is positioned adjacent the sheet 10 on roll 11, it forms with the roll a trough in which a pond or puddle of coating material 22 is held. As is conventional in the art, the coating material may be supplied from a header built into the doctor back and connected to multiple pipes discharging into the bottom of the puddle. Large slotted openings in the doctor back (not shown) may be provided to serve as passages for overflow, permitting recirculation of the coating as desired.

The doctor assembly 16 is supported between a pair of swing arms such as the arms 23 and 24 which are pivotally supported (preferably by anti-friction bearings) on the shaft 12 and which may be adjustably held in any desired position by any conventional mechanism known in the art. In the position shown in FIGURE 1, the arms 23 and 24 hold the doctor assembly 16 in the working or coating position. As is known in the art, however, it is frequently desirable when changing blades or doctor assemblies to be able to vary the position of the doctor. This may be achieved either by known pneumatic means (not shown) or by any other convenient means such as a latch or pin mechanism holding the arms 23 and 24 in adjustably fixed position with respect to the supports 13 and 14.

The doctor assembly 16 is supported between the pivot arms 23 and 24 by any convenient means which will permit the doctor assembly to be moved transversely of the sheet 10, that is, in a direction parallel to the axis of the roll 11 as indicated by the arrows 25. Of course, this transverse motion is intended to occur while the pivot arms 23 and 24 are in a fixed position and after the doctor assembly 16 has been rotated into operating position as shown in FIGURE 1. One possible structure for permitting this transverse vibratory, reciprocating, or oscillatory movement is shown in FIGURE 1 as comprising a pair of mounting rods 26 and 27 which may be integrally attached to the back member 19 of the doctor assembly and which extend outwardly therefrom through holes in the respective pivot arm members 23 and 24. Rods 26 and 27 are preferably mounted in the holes in the pivot arms 23 and 24 by anti-friction bearings so that the doctor assembly may be easily reciprocated or oscillated in a direction parallel to the axis of roll 11 and transverse to the surface of sheet 10. Rods 26 and 27 may be attached by internally threaded coupling members 28 and 29 to a mating pair of rods 30 and 31 which may project from a vibrator assembly 32 mounted adjacent to the roll coating assembly. The coupling members 28 and 29 are internally threaded at each end for engagement with the rods 26 and 30 and 27 and 31 respectively, and are provided so that the doctor assembly 16 may be detached from the vibrator 32 in order to remove the doctor assembly for cleaning or repair purposes. Although only a single vibrator assembly 32 is shown attached to one end of the rods 26 and 27, it will be under-

stood that for extremely heavy installations or where extremely high frequency vibrations are desired, a similar vibrator assembly 32 could be attached to the other end of the rods 26 and 27 and connected to work in push-pull fashion with the vibrator 32 shown in the drawing. As shown in FIGURE 1, the rods 26 and 27 are provided with nuts 33 and 34 on their opposite ends to prevent accidental disengagement of the doctor assembly 16 from the pivot arm 23.

The vibrator or transducer 32 may be of any convenient type either electromagnetic, electric motor driven, pneumatic, or other. The only requirement on the vibrator is that it have sufficient power to oscillate the particular doctor assembly being used in a given application at the desired frequency. As shown by way of example on the drawing, the vibrator 32 comprises a housing 33 mounted on supporting pedestals 34 and 35 and containing an electromagnetic solenoid coil actuator assembly. The solenoid coil 36 and its associated core member 37 contained therein may conveniently be mounted in housing 33 by a support member 38. The actuating rods 30 and 31 extend through one side of the housing 33 (preferably through antifriction bearing supports) and are attached to a plate member 39 as by nuts 40 and 41 securing threaded ends of the rods to the plate 39. Plate 39 is in turn rigidly or integrally attached to the core member 37 by a rod 42. A tension spring 43 connected between core member 37 and the rear wall of the housing 33, and a compression spring 44 connected between the front wall of the housing 33 and the plate 39 cooperate with each other to urge the rod and core assembly toward the left as seen in FIGURES 2 and 1. As shown on the drawing, the coil 36 is actuated by electrical power supplied through leads (not shown) which generates a magnetic field holding the core member 37, the integrally attached rod assembly, and the doctor assembly 16 in the position shown in the drawing. When the power is turned off, the core and rod assembly moves to the left as seen in FIGURE 2 thereby moving the doctor assembly to the left as seen in FIGURE 1 under the combined action of the springs 43 and 44. In order to achieve the desired reciprocating or oscillatory motion of the doctor assembly 16, it is thus only necessary to supply pulsating unidirectional current to the coil 36 at a frequency corresponding to the desired frequency of transverse vibration of the doctor assembly.

It is thus seen that in accordance with the present invention, there is applied to one or both ends of a coating blade, or its holder, a source of high frequency vibration to provide improved control of the quantity of coating delivered by the trailing blade coater. The vibration applied to the blade 17 of doctor assembly 16 permits the hard particles deposited from the coating color or solution to be released from under the blade rather than to remain lodged there and thereby prevents streaks and scratches on the surface of the material 10. The frequency of vibration has not been found to be critical. It should be related to the speed of the web being processed and is also related to the viscosity and/or plasticity of the color being used. With frequencies greater than a predetermined value, which may be determined by experiment for the particular color being applied, the vibrations also have the result of keeping the doctor blade or other coating means relatively clean from partially dried coatings which are a major source of the grit particles mentioned above. Usable frequencies for the longitudinal vibration of the blade and/or blade holder would in general be from 60 cycles per second upwardly. As pointed out above, both web speed and coating viscosity will influence the choice of the vibratory rate.

By way of example only, it has been found that using a common casein bound clay coating at a web speed of 700 feet per minute, vibrations of the order of 400 cycles per second are effective to achieve the desired results. However, the disadvantage of using higher frequencies would

lie only in the expense of providing the necessarily increased energy to produce such high frequency vibrations. With the exemplary values given above, it was found that coating would be released from the boundary walls of the pond of coating material on the blade. This, in turn, avoids the drying out of the particles lying above the pond level. These particles are the usual source of the streak and scratches commonly produced by prior art techniques. It was also found that these vibrations tended to reduce these particles again to their normal size permitting them to flow more smoothly onto the web being coated.

It will, of course, also be realized that the method and apparatus described herein can be adapted to other coating and/or smoothing and leveling devices provided only that the energy output of the transducer is sufficient to oscillate the mass of the smoothing member and that the detailed discussion of application of the technique to the coating of paper in is intended by way of illustrative example only.

While a particular exemplary preferred embodiment of the invention has been described in detail above, it will be understood that modifications and variations therein may be effected without departing from the true spirit and scope of the novel concepts of the present invention as defined by the following claims.

I claim as my invention:

1. Apparatus for coating a web of paper comprising, a generally cylindrical back-up roller mounted for rotation about the longitudinal axis thereof and having a peripheral surface which is adapted to support said web, a doctor blade assembly, said doctor blade assembly comprising a trough-like member having one open side positioned adjacent said peripheral surface of said roller to form with said web on said roller a reservoir for containing coating substance, a doctor blade smoothing member mounted at the bottom of said trough-like member downstream of said coating substance and positioned to contact said coated web to smooth said coating substance thereon, means to mount said doctor blade assembly in predetermined relationship to said roller such that the edge of said smoothing blade is parallel to said longitudinal axis of said roller, and means to oscillate said doctor blade assembly transversely of said web and said peripheral surface of said roller in a direction parallel to said longitudinal axis of said roller.

2. Apparatus for coating a web of paper comprising a generally cylindrical back-up roller mounted for rotation about the longitudinal axis thereof, the peripheral surface of said roller providing a traveling surface to support one surface of said web, means to apply coating substance to the opposite surface of said web including a doctor blade for smoothing the said opposite surface of said web and means for oscillating said means to apply coating substance and said doctor blade, said doctor blade being connected to said means for applying a coating substance.

3. Coating apparatus comprising a roller member mounted for rotation about a longitudinal axis thereof and having a traveling surface positioned to support a sheet of material to be coated, means to apply coating substance to a surface of said material including doctor blade means positioned to smooth said coating substance on said surface of said material, and means to oscillate said means to apply coating substance and said doctor blade means transversely of said surface of said material and parallel to said longitudinal axis of said roller.

4. A method of coating a web of paper comprising, supporting said web against a backup surface, moving the supported web past a doctor blade assembly, feeding a supply of coating substance to a surface of said web from said doctor blade assembly and simultaneously vibrating said doctor blade assembly to control the quantity of coating substance delivered to the web, and prevent streaking and unevenness in the coating on the web.

5. A method of coating a web of paper comprising,

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supporting said web against a backup surface, moving the supported web past a doctor blade assembly, feeding a supply of coating substance to a surface of said web from said doctor blade assembly and simultaneously vibrating said doctor blade assembly at a frequency greater than 60 cycles per second, to control the quantity of coating substance delivered to the web and prevent streaking and unevenness in the coating on the web.

6. Coating apparatus comprising a roller member mounted for rotation about a longitudinal axis thereof and having a traveling surface positioned to support a sheet of material to be coated, a container for coating substance having a bottom wall, a side wall and opposed end walls and positioned to cooperate with the roller member so that the roller member provides another side wall thereof, and means to oscillate the container axially of the roller to control the rate of feeding of the coating substance to the roller member or a web thereon of paper or the like.

7. Coating apparatus comprising a roller member mounted for rotation about a longitudinal axis thereof and having a traveling surface positioned to support a sheet of material to be coated, a container for coating substance having a bottom wall, a side wall and opposed end walls and positioned to cooperate with the roller member

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so that the roller member provides another side wall thereof, and means to oscillate the container axially of the roller to control the rate of feeding of the coating substance to the roller member or a web thereon of paper or the like, said bottom wall being formed by a doctor blade oscillated with said container to prevent particles from sticking thereon and to afford a smooth coating surface.

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