Jan. 22, 1946. H. R. HARRIGAN 2,393,529

APPARATUS FOR APPLYING COATINGS TO WEB MATERIAL

Filed Jan. 19, 1940

FIG. 1

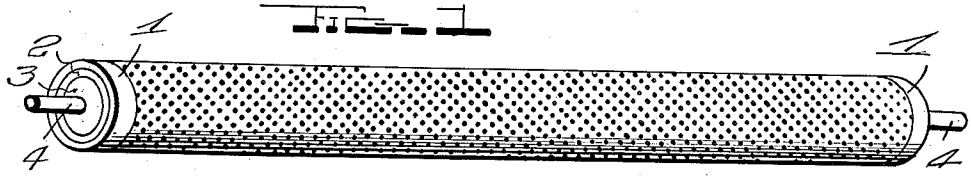


FIG. 2

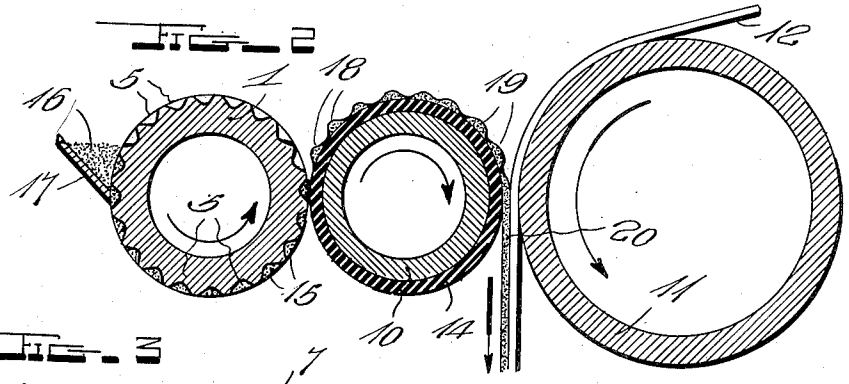


FIG. 3

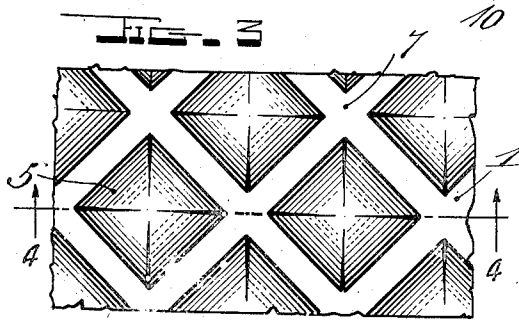


FIG. 4

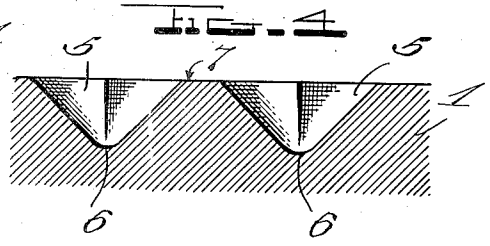


FIG. 5

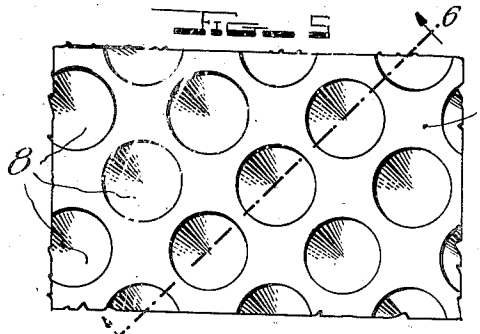


FIG. 6

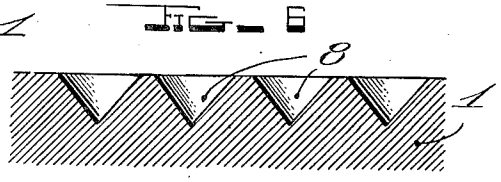


FIG. 7

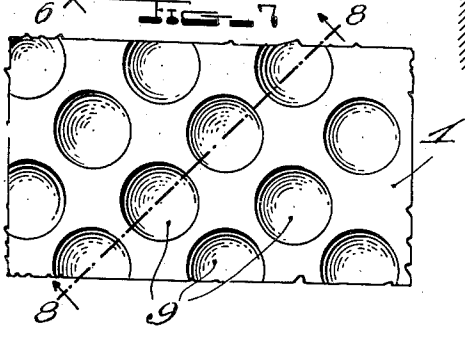
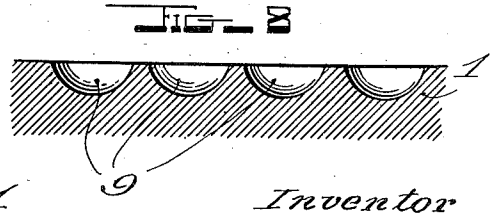


FIG. 8



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Patented Jan. 22, 1946

2,393,529

UNITED STATES PATENT OFFICE

2,393,529

APPARATUS FOR APPLYING COATINGS TO WEB MATERIAL

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Application January 19, 1940, Serial No. 314,695

4 Claims. (Cl. 91—50)

My invention relates broadly to coating machinery and more particularly to an apparatus for applying coating upon web material.

This application is a continuation-in-part of my application Serial No. 301,280, filed October 25, 1939, for Process of printing, coating and/or decorating web material, and which has now matured into Patent 2,293,690, issued August 18, 1942.

An object of my invention is to provide a construction of coating apparatus by which a uniform film of coating may be applied to web material in which the surface tension and density of the coating material are proportioned to the area of the surface of the coating means for insuring the uniform distribution of a film of coating material over the web material.

Another object of my invention is to provide a construction of coating apparatus for applying a uniform and continuous film of coating to web material in which a multiplicity of receptacle-like pockets are arranged in the surface of the coating equipment in such spacial relation that a coating may be delivered to an off-set surface for subsequent delivery to the web material being coated in a substantially continuous film.

A further object of my invention is to provide a combination of coating delivery roller, off-set roller and bed roll over which web material is moved where the delivery roller is provided with a multiplicity of preformed recesses operative to collect and deliver the coating material to the off-set roller in such quantities and in such spaced positions that a continuous and uniform film of coating may be transferred to the web material.

A still further object of my invention is to provide a construction of a coating delivery roller containing a multiplicity of pockets of such shape and size and disposed in such spacial relation that quantities of coating may be delivered to an off-set roller and merged into a substantially continuous uniform film for transfer to web material operating over a bed roll.

Other and further objects of my invention reside in an apparatus for applying continuous and uniform coatings to web material as set forth more fully in the specification hereinafter following by reference to the accompanying drawing, in which:

Figure 1 is a perspective view of a coating, collecting and distributing roller constructed in accordance with my invention; Fig. 2 is a transverse view on an enlarged and exaggerated scale showing the combined assembly of a coating and distributing roller, an off-set roller and a bed roll over which web material passes when operating in accordance with my invention; Fig. 3 is an enlarged or greatly magnified fragmentary plan view showing a portion of the surface of the coating, collecting and distributing roller and indicating one construction of preformed recesses for coating material which may be contained in the surface of the roller, the recesses being illustrated as inverted pyramids; Fig. 4 is a sectional view taken on a section extending substantially parallel with respect to the longitudinal axis of the coating, collecting and distributing roller; Fig. 5 shows a modified arrangement of recesses in the surface of the coating, collecting and distributing roller wherein the recesses are shaped as inverted cones; Fig. 6 is a cross sectional view taken on line 6—6 of Fig. 5 at approximately 45° to the longitudinal axis of the coating, collecting and distributing roller; Fig. 7 is a fragmentary plan view of a further modified form of recessed surface for the coating, collecting and distributing roller in which the recesses are in the form of inverted semi-spherical cup-like pockets; and Fig. 8 is a transverse sectional view taken on line 8—8 of Fig. 7 at an angle of approximately 45° to the longitudinal axis of the coating, collecting and distributing roller.

For the purpose of explaining my invention, I have illustrated the invention as applied particularly to the coating of paper although it will be understood that my invention is by no means limited thereto and is applicable to coating generally. In the coating of paper, I employ an ink constituted by an aqueous mixture or oil in water emulsion printing ink having selected viscosity as proportioned to the depth of the recesses in the ink collecting and distributing roller as will permit the rapidly moving coacting off-set roller to receive the ink deposits from the recesses at such spaced positions on the surface of the off-set roller that the deposits of ink may gravitate or merge into a film of uniform thickness by the time that the off-set roller moves to a position for transferring the ink to the web material to be coated. My invention contemplates the disposition of regularly formed and uniformly spaced pockets about the cylindrical surface of a coating, collecting and distributing roller where the area of the pockets is in excess of the area of the spaces between the pockets so that the ink when deposited on the surface of the off-set roller may merge into a continuous film as the ink on the surface of the off-set roller approaches the web material in its movement over the bed roll. I employ an off-set roller having a resilient

surface constituted for example, by pliable rubber so that the adhesion brought about by the coaction between the surface of the off-set roller and the surface of the coating, collecting and distributing roller tends to draw out the ink from the pockets for movement on the off-set roller. The distortion of the resilient surface of the off-set roller facilitates the picking out of the ink deposits from the pockets in the coating, collecting and distributing roller to enable the ink to be spread as a film upon the off-set or transfer roller.

The recesses formed in the surface of the coating, collecting and distributing roller are preformed to quickly discharge ink or other coating material collected therein. There is no reentrant or undercut portion associated with any of the recesses. I have found several preformed shapes applicable, such as the inverted pyramids, the inverted cones and the inverted semi-spherical cup-like recesses shown in the drawing. The area of the pockets is in excess of the spaces between the pockets so that the deposits upon the off-set roller occur at such frequency that as the off-set roller advances toward the web material, the ink tends to merge into a continuous film of uniform proportions. The measure provided by the recesses or pockets is struck off before the ink or coating is delivered to the surface of the off-set roller to insure the continuous performance of the coating equipment with uniformity.

Referring to the drawing in more detail, reference character 1 indicates a close grained metal sheath constituting the cylindrical coating, collecting and distributing roller. This close grained metal sheath 1 is preferably formed by an electrolytic process by electrolytically depositing copper on a hollow steel drum indicated generally at 2. The hollow steel drum may be provided with plugs 3 at opposite ends from which stub shafts 4 extend. The electrolytically deposited close grained copper sheath 1 may then be engraved or knurled to provide the preformed recesses shown as examples in Figs. 3, 5 or 7. The preformed recesses extend in a spiral pattern running at approximately 45° with respect to the longitudinal axis of the roller passing through stub shafts 4. After the recesses are formed by the knurling or engraving process, the knurled or engraved roller may be chromium plated or the surface otherwise finished to provide a series of smooth recesses.

The number of recesses is approximately 85 to the inch with the remote edge of one recess spaced from the leading edge of an adjacent recess approximately $1/425''$. The width of each recess is approximately $4/425''$. That is to say, there are approximately 85 recesses to the inch, measuring along an axis disposed at 45° to the longitudinal axis of the ink collecting and distributing roller and the spacing between the bases of the recesses is approximately ¼ of the width of the recess at its base.

In Fig. 3 I have shown the recesses in the shape of inverted pyramids indicated at 5 having rounded apexes at 6 which readily release the coating material. The relatively narrow ledge 7 between the recesses insures delivery of the ink or coating to the off-set roller at frequent intervals.

In Fig. 5 I have shown the recesses in the form of inverted cones 8 with the apexes of the cones directed downwardly into the surface of the coating, collecting and distributing roller and the bases thereof open for free delivery of the ink or coating without restriction.

In Fig. 7 I have shown the recesses in the surface of the collecting and distributing roller 1 in the form of semi-cylindrical cup-like portions 9 adapted to release the ink quickly to the surface of the off-set roller.

In Fig. 2 I have shown the association of the collecting and distributing roller 1 with the off-set roller 10 and with the bed roll 11. The web material is shown at 12 passing over bed roll 11 and between the resilient surface 14 of off-set roller 10 and the surface of the bed roll. The surface 14 of the off-set roller 10 is yieldable or pliable or resilient, whereby the surface 14 performs the very important function of picking out by suction forces the ink which I have indicated at 15 in recesses 5. The ink which is supplied to the ink collecting and distributing roller 1 is indicated at 16 gravitating into the recesses 5 as collecting and distributing roller 1 revolves. The doctor 17 strikes off the ink to the level of the bases of the recesses as shown. As the yieldable surface 14 of off-set roller 10 moves toward and away from the recesses 5, the ink accumulated therein is delivered to the resilient surface 14 as indicated at 18. As off-set roller 10 continues to move in a clockwise direction, the accumulated quantities of ink 18 tends to gravitate into a homogeneous film represented at 19 until the ink gravitates downwardly into a continuous uniform film 20 meeting the web material 12 in its passage around the bed roll 11. Thus, measured quantities of coating are impressed upon the web material in a continuous uniform film which may be depended upon through long and extended production processes to repeat in substantially uniform manner.

While I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an apparatus for coating web material, the combination with a transfer member having a substantially smooth and non-absorbent surface for transferring fluid coating material to the web material, of a fluid feeding roller maintained out of contact with the web material and having a multiplicity of equal and uniform minute pocket-like surface indentations distributed over substantially the entire surface of said roller, said indentations being regularly spaced and operative to receive and measure equal minute portions of the fluid coating material and the area of indentations being in excess of the spacing surfaces between said indentations, whereby said roller is operable to deposit fluid coating material in separate minute portions from said indentations upon the surface of said transfer member to merge thereon and be transferred therefrom to said web material as a continuous film of substantially uniform thickness throughout the area of the web material.

2. In an apparatus for coating web material, the combination with a transfer member having a substantially smooth and non-absorbent surface for transferring fluid coating material to the web material, of a fluid feeding roller maintained out of contact with the web material and having a multiplicity of equal and uniform minute pocket-like surface indentations of inverted

pyramidal contour distributed over substantially the entire surface of said roller, said inverted pyramidal indentations being regularly spaced and operative to receive and measure equal minute portions of the fluid coating material and the area of indentations being in excess of the spacing surfaces between said indentations, whereby said roller is operable to deposit fluid coating material in separate minute portions from said inverted pyramidal indentations upon the surface of said transfer member to merge thereon and be transferred therefrom to said web material as a continuous film of substantially uniform thickness throughout the area of the web material.

3. In an apparatus for coating web material, the combination with a transfer member having a substantially smooth and non-absorbent surface for transferring fluid coating material to the web material, of a fluid feeding roller maintained out of contact with the web material and having a multiplicity of equal and uniform minute pocket-like surface indentations of inverted frusto-conical contour distributed over substantially the entire surface of said roller, said inverted frusto-conical indentations being regularly spaced and operative to receive and measure equal minute portions of the fluid coating material and the area of indentations being in excess of the spacing surfaces between said indentations, whereby said roller is operable to deposit fluid coating material in separate minute portions from said inverted frusto-conical indentations upon the surface of said transfer member to merge thereon and be transferred therefrom to said web material as a continuous film of substantially uniform thickness throughout the area of said web material.

4. In an apparatus for coating web material, the combination with a transfer member having a substantially smooth and non-absorbent surface for transferring fluid coating material to the web material, of a fluid feeding roller maintained out of contact with the web material and having a multiplicity of equal and uniform minute pocket-like surface indentations of inverted pyramidal contour rounded at the apexes thereof distributed over substantially the entire surface of said roller, said inverted pyramidal indentations being regularly spaced and operative to receive and measure equal minute portions of the fluid coating material and the area of indentations being in excess of the spacing surfaces between said indentations, whereby said roller is operable to deposit fluid coating material in separate minute portions from said inverted pyramidal indentations for release from the rounded apexes thereof upon the surface of said transfer member to merge thereon and be transferred therefrom to said web material as a continuous film of substantially uniform thickness throughout the area of said web material.

HERMAN R. HARRIGAN.