Aug. 25, 1936. F. R. CHAPPELL 2,052,131

SPREADING, EXTRUDING, OR LIKE OPERATIONS

Filed Oct. 10, 1933

Fig. 1.

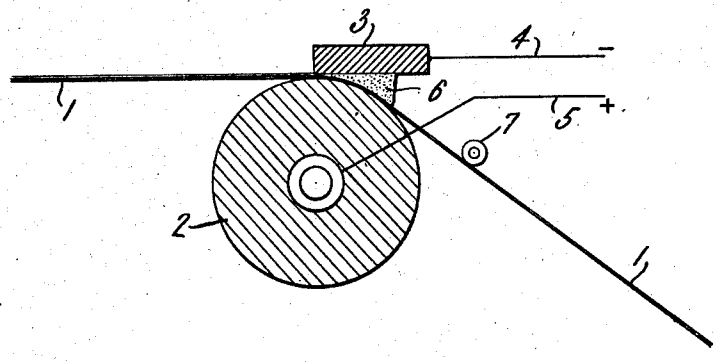


Fig. 2.

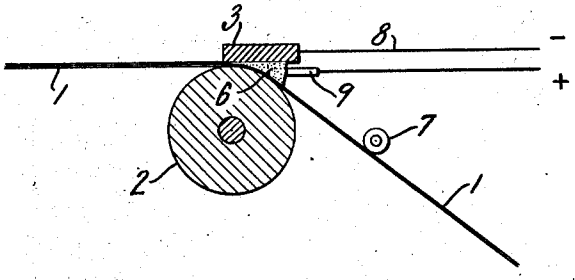
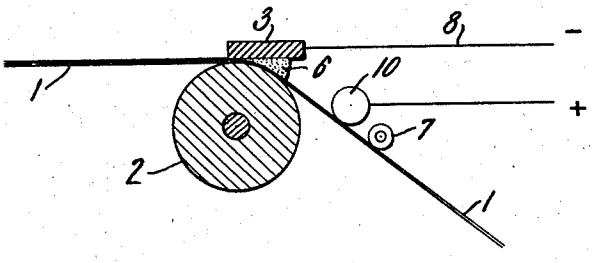


Fig. 3.



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SPREADING, EXTRUDING, OR LIKE OPERATIONS

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Application October 10, 1933, Serial No. 692,931

6 Claims. (Cl. 91—68)

This invention relates to spreading, extruding or like operations, and more particularly to such operations wherein a material is coated with an organic substance, such as rubber for example, from an aqueous dispersion of the same.

In general, materials may be coated with rubber or rubber-like material from aqueous dispersions of the same, such as natural or artificial latices, by electrolytic deposition processes or by mechanical operations such as spreading, extrusion, dipping, spraying and the like. In coating fabric, for example, by electrolytic deposition, the material to be coated is passed between positive and negative electrodes submerged in a bath of alkaline preserved latex contained within a receptacle, whereby the negatively charged rubber globules in the latex migrate toward the anode and are deposited by electrophoresis upon that side of the interposed fabric material which is remote from the anode. Migration in the reverse direction of course takes place in the case of an acid dispersion in which the rubber globules are positively charged and hence migrate toward the cathode. In coating sheet material, on the other hand, for example by a mechanical operation, the aqueous dispersion of rubber, preferably in the form of a thick paste, may be fed to one face of the material, and spread evenly thereon by means of an ordinary doctor knife or like apparatus and dried. At relatively slow speeds, such spreading operations are satisfactory, but when an attempt is made to speed up the passage of the sheet material beneath the spreader a rough uneven surface of the rubber deposit results, since the dispersion paste tends to adhere to and upon the spreader knife.

The present invention relates to such mechanical spreading or extrusion or like operations wherein a confining, and shaping or distributing member operates upon the aqueous dispersion to coat a substance with such dispersion or to shape the material. The present invention is applicable to various types of apparatus but it will be described in detail, for convenience, as applied to a spreading apparatus for coating sheet material, such as fabric, as shown in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view partly in cross section of a device for coating fabric in accordance with the present invention, and

Figs. 2 and 3 are modified forms of the apparatus shown in Fig. 1.

In carrying out the present invention, an electrical potential difference is maintained between the dispersion and the confining, and distributing or shaping member operating on the dispersion in the spreading, extruding, or like apparatus. It is found that when the confining member has an electrical charge similar in sign to the charge of the disperse phase of the dispersion, there is effected an accumulation of water at that edge or surface of the confining member which is in contact with the dispersion. This accumulation or film of water on the confining member acts as a lubricant and prevents adhesion of the dispersion to the confining member and the formation of incrustations, which would produce a rough-surfaced coating. In an alkaline aqueous dispersion of rubber, the rubber particles are negatively charged, and therefore the confining member is made the cathode. The accumulation of water at the cathode is accounted for by the fact that the negatively charged particles in those portions of the coating material which are adjacent to the cathodic shaping or spreading member tend to migrate away from the cathode and at the same time the water tends to migrate toward the cathode, thereby producing adjacent to the cathode surface a thin layer of liquid phase which is relatively free of dispersed particles. This increased concentration of water at the areas of contact between the confining member and the dispersion enables the speed of travel of the material being coated, particularly in the case of fabric, with a thick dispersion paste, to be materially increased over the speed practicable with previous spreading methods, and it also permits the smooth spreading of such pastes as may be entirely too viscous to be spread smoothly by such previous spreading methods.

In a like manner a potential difference may be maintained between, on the one hand, a metallic extrusion die, and on the other hand, the body of the dispersion paste being extruded, or, in case the extrusion process is a coating operation, between the metallic die and the material being coated, such as a wire, for example. In the case of the extrusion of a dispersion paste to form a thread, film or sheet or like product, the extrusion die, insulated of course from the body of the machine, is maintained at a negative potential with respect to the body of the machine, the latter serving as the anode member and preferably being grounded. In the case of coating, as in coating a wire for example, it is obvious that either the wire or the body of the machine may serve as the anode member.

It is clear that the process of the present invention is wholly distinct from processes wherein

rubber from latex is cataphoretically precipitated upon a moving fabric, interposed between a cathode and a supporting member containing within it an anode. The present process is fundamentally a mechanical spreading process, wherein the migratory properties of dispersed particles under the influence of an electric field, or potential gradient, are utilized to provide a thin layer of relatively dilute dispersion at the contact surface between the dispersion and the confining, and distributing or shaping member such as a spreader bar or doctor, or extrusion die. The thickness of the coatings obtainable by the present process is nowise dependent upon the conditions which would govern the thickness of a coating deposited by electrophoresis upon a similar backing. Such negligible electrophoretic deposition as may occur in the present process does not operate to increase the amount of rubber applied to the backing but can only result in a slight coagulation, adjacent to the backing, of the latex which has already been deposited there by the mechanical action of the spreader bar.

Referring more particularly to the drawing, the invention is illustrated as applied to an apparatus for coating fabric wherein the fabric material and the spreading means provide an extrusion orifice for the dispersion paste. This spreading apparatus illustrated in the drawing wherein the spreading means and the material to be coated form an extrusion orifice for the dispersion paste to be spread is the subject matter of the patent to Raymond J. O'Brien and Francis R. Chappell, No. 1,972,457, granted Sept. 4, 1934, and no claim is made herein for such apparatus per se.

In the apparatus of Fig. 1 a suitable sheet material 1, such as fabric, which it is desired to coat, is passed over an anvil roll 2, and under a spreader bar 3 which is positioned over the anvil roll. The spreader bar 3 is constructed of electro-conducting material and is insulated from the rest of the equipment and is connected to the negative pole of a direct current supply circuit by means of lead 4. The positive pole of the supply circuit is connected by means of lead 5 to the anvil 2 over which the material to be coated is moved continuously by any suitable means, not shown. The dispersion 6 which is to coat the material 1, may be an aqueous dispersion of rubber or rubber-like material, either natural or artificially prepared, or a dispersion of other dispersible material in which the dispersed particles carry negative electric charges. A wetting roll 7 is provided for moistening the material to be coated, preferably with an electrolyte solution, so as to insure its being electroconductive. When the material is electroconductive per se the wetting roll may be eliminated, if desired.

In the modification shown in Fig. 2, a spreader bar or knife 3 is connected to a suitable source of current by the lead 8 and is made the cathode as in Fig. 1. The positive pole of the current supply is connected to a fixed electrode 9 arranged to contact with the mass 6 of the dispersion to be spread, either in the position shown, or in a supply tank which may be provided adjacent the spreader knife 3. In this modification a potential difference is thus maintained directly between the spreader knife 3 and the body of the dispersion, so that the anvil roll 2 and the material being coated are not utilized to complete the circuit; hence such apparatus as is shown in Fig. 2 may also be used for coating sheets of non-conductive material such as rubber and the like, as well as fabric, paper, etc.

In the modification shown in Fig. 3 the spreader knife 3 is again the cathode while the anode is in the form of a contact roll 10 making electrical contact with a surface of the material to be coated, after the latter has been moistened by means of a wetting roll 7 or rendered electroconductive, if necessary, in any other suitable manner.

In the various figures the spreader knife has been made the cathode, whereby the dilution of a dispersion of negatively charged particles will be effected at the contacting surface of the spreader knife, thus providing lubrication between the dispersion and the spreader knife.

It is obvious that in spreading or extruding a dispersion paste wherein the dispersed particles are positively charged, such as a so-called acid latex and other rubber and like dispersions having a pH of less than 4.5, lubrication of the contacting surface of the spreader bar or extrusion die may be effected according to the invention by utilizing the spreader bar or the extrusion die as the anode, whereby to maintain the same at a positive potential with respect to the dispersion. The potential gradient required varies with the materials acted upon and the effect which it is desired to obtain. It has been found that potential differences of up to 220 volts are satisfactory for most purposes. Such voltages lower than 220 volts may be used as are consistent with the speed at which it is desired to operate the spreading machine and of course depending on the concentration, viscosity and conductivity of the paste to be spread.

While specific embodiments of the invention have been described, it is obvious that numerous modifications may be made therein and it is not desired to limit the invention otherwise than as set forth in the appended claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. In a spreading, extruding or like operation, the method of preventing adhesion between an aqueous dispersion of an organic substance and a confining, and distributing or shaping member for such dispersion and from which member the dispersion emerges from frictional contact therewith, which comprises maintaining an electrical potential difference between said confining, and distributing or shaping member and said dispersion, the electrical charge on the confining, and shaping or distributing member being similar in sign to the charge on the particles of the disperse phase of the dispersion, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the confining, and distributing or shaping member by electrophoresis.

2. In the process of coating material with an aqueous dispersion of an organic substance by means of a confining and distributing member from which such dispersion emerges from frictional contact therewith, the step of maintaining an electrical potential difference between said confining and distributing member and said dispersion, the electrical charge on the confining and distributing member being similar in sign to the charge on the particles of the disperse phase of the dispersion, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the confining, and distributing member by electrophoresis.

3. The method of coating material with an organic substance which comprises spreading an aqueous dispersion of such organic substance on the material by means of a confining and distributing member from which the dispersion emerges from frictional contact therewith, and maintaining an electrical potential difference between the confining and distributing member and the dispersion, the electrical charge on the confining and distributing member being similar in sign to the charge on the particles of the disperse phase of the dispersion, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the confining and distributing member by electrophoresis.

4. The method of coating material with an organic substance which comprises pressing an aqueous dispersion of such organic substance on the material by means of a distributing member from which the dispersion emerges from frictional contact therewith, and maintaining an electrical potential difference between the pressing means and the dispersion, the electrical charge on the pressing and distributing member being similar in sign to the charge on the particles of the disperse phase of the dispersion, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the pressing and distributing member by electrophoresis.

5. The method of continuously coating sheet material with an aqueous dispersion of an organic substance which comprises moving the sheet material relatively to a distributing member from which the dispersion emerges from frictional contact therewith and spreading such dispersion on the sheet material while maintaining an electrical potential difference between the distributing member and the dispersion, the electrical charge on the distributing member being similar in sign to the charge on the particles of the disperse phase of the dispersion, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the distributing member by electrophoresis.

6. In an apparatus for spreading or extruding an aqueous dispersion paste, an electro-conductive confining, and distributing or shaping member for the dispersion and from which the dispersion emerges in frictional contact therewith, means for supplying to the confining, and distributing or shaping member an electrical charge which is similar in sign to the charge on the particles of the disperse phase of the dispersion, and means for supplying an electrical charge of a different polarity to the dispersion to maintain an electrical potential difference between the confining, and distributing or shaping member and the body of the dispersion in contact therewith, whereby a lubricating film of the dispersion of greater fluidity than the body of the dispersion is maintained at the interface of the dispersion and the confining, and distributing or shaping member by electrophoresis.

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