April 21, 1931. J. J. F. STOCK 1,801,374

PROCESS AND DEVICE FOR THE APPLICATION OF LIQUIDS TO MOVING BANDS OF MATERIAL

Filed Jan. 12, 1927

Fig. 1.

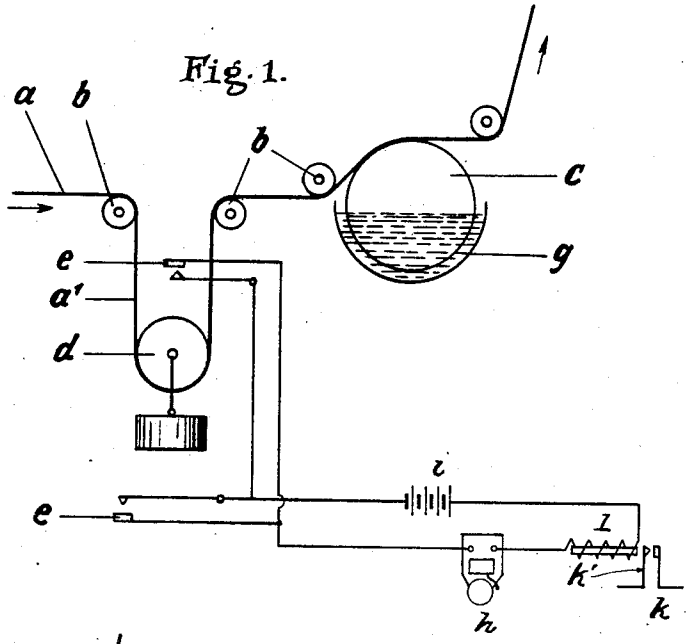


Fig. 2

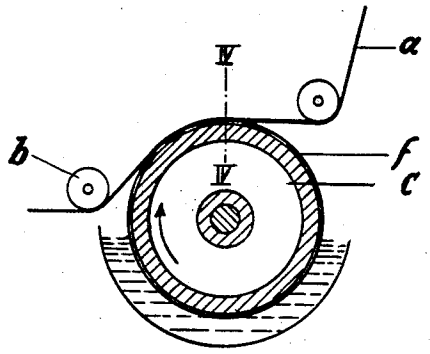
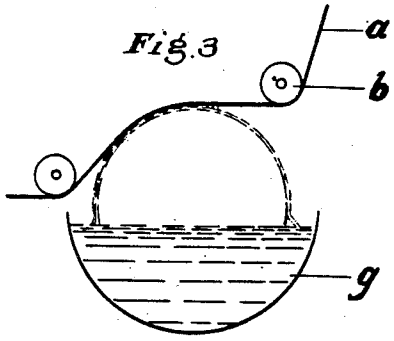


Fig. 3



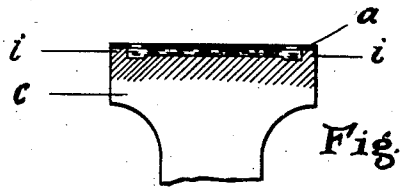


Fig. 4.

Inventor,
Johann Jacob Friedrich Stock
by Dowell & Dowell
his Attorneys.

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UNITED STATES PATENT OFFICE

JOHANN JACOB FRIEDRICH STOCK, OF MUNICH, GERMANY

PROCESS AND DEVICE FOR THE APPLICATION OF LIQUIDS TO MOVING BANDS OF MATERIAL

Application filed January 12, 1927, Serial No. 160,726, and in Germany January 14, 1926.

This invention relates to devices for applying liquids to bands or strips of material, such as photographic films and the like, for the purpose of coloring, varnishing, emulsioning, and regenerating the same. The operation of applying liquids to such material for the stated purpose must be carried out with utmost care, especially in the case of of cinematographic films because a thoroughly even application is of paramount importance and if perforated films are to be treated, great care must be exercised in order to prevent the liquid from passing through the perforations onto the other side of the film.

According to certain prior art practices, rollers are used for the application of liquids to the cinematographic films. However, these rollers having plain or smooth circumferences are not able to effect an even application of the liquids to the films, so that additional means, such as brushes must be used to distribute the material, while still other means are employed to prevent the liquid from passing through the perforations on the film.

According to other prior art practices the film is passed from a point above onto the surface of a liquid so that the surface of the film would only just touch the level of the liquid. However, the method or process proved to be impractical and has been abandoned. The film would often immerse too deep while at other times it would not even touch the liquid level. The contact of the film surface with the liquid level must be exceedingly slight, and since the travel of the film past the liquid level depends on many circumstances, it is practically impossible to effect it with the necessary accuracy.

This invention provides an improvement over the last mentioned process and solves the problem in an efficient manner by making use of the capillary and cohesive properties of the liquids with the assistance of certain mechanical devices.

In one embodiment of the invention a roller which is preferably metallic is employed to rotate with its lower portion in a reservoir of the liquid to be applied, and is provided with a shallow circumferential groove, or crevice of a width corresponding to the width of the band, or to that portion thereof which is to be treated with the liquid. The liquid is maintained at a constant level within its reservoir, and when said roller is rotated therein at a predetermined speed, it takes up the liquid upon its circumference, mainly within its circumstantial groove, and carries the liquid therearound in the shape of a very fine sheet or film. The band or film to be treated is passed with its sides over lateral or marginal ridges of the roller, so that the central portion of the film bridges the crevice of the latter and is thus caused to be in slight superficial contact with the circulating thin sheet of liquid within said crevice. Owing to the cohesion of the liquid particles, this sheet or film of liquid adheres to the band and breaks away only after the film has left the roller in the diverging angle formed between the film and roller.

The accompanying drawing illustrates, by way of example, a device for carrying out the aforesaid process.

Fig. 1 diagrammatically illustrates the arrangement in side elevation.

Fig. 2 is a section of the roller and through the liquid reservoir or container.

Fig. 3 is a diagram illustrating the principle of the invention and shows the film or sheet of liquid free from the roller in an exaggerated representation.

Fig. 4 is a section on the line IV—IV of Fig. 2, on an enlarged scale.

In the drawings a band or film a is represented under treatment in this instance of solvents or the like, for the purpose of regenerating it so as to remove scratches and other deficiencies. Said film is assumed to have been first run through a cleaning device preferably embodying a metal wire brush and a vacuum cleaner. The aforesaid cleaning device forms no part of the present invention and therefore is not shown in the drawing. After the application of the liquid by means of the inventive device, as will presently be described, the film is passed through one or more chambers of the machine for any further treatment that may be required. Such further treat-

ment and the means for effecting it are likewise immaterial to the present invention and are accordingly omitted from the drawings.

Guide rolls *b* serve to lead the film in known manner through the machine and over the liquid applying disc or roller *c* having a circumferential groove or crevice carrying a film or sheet of the liquid in application to one surface of the film band as previously described. The resilient tension of the film band which is required to ensure a correct travel, and above all, an even application of the liquid, is exerted by a weighted roller *d* which is freely suspended in a depending loop *a'* formed in the film before its communication with said rollers *c*. Above and below said weighted roller are electric contacts *e* and *e'* adapted to close a circuit from a battery *i* or other source of electricity. When the weighted roller is moved sufficiently to close one of the contacts *e* and *e'*, a bell *h* in the circuit will sound and, at the same time, an automatic or other switch *k* in the motor-circuit is opened by a relay *l* becoming energized and attracting the arm *k'* of said switch in known manner. The electric connections and the way of the current are evident and they are, therefore, not specially referred to. Closing the contact *e* takes place when the tension of the band *a* becomes excessive, while undue slackness would cause the roller *d* to descend and close the contact *e'* by its weight.

The essential feature of this invention is the roller *c* for the application of the liquid. Said roller turns in anti-friction bearings (not shown) and is driven at a speed proportional to that of the film passing over it. It is therefore preferably driven by contact with the moving film itself. Around its circumference the roller *c* is provided with a shallow groove or crevice *f*. Its lower portion extends into a trough or the like *g* in which the liquid which is applied to the film is kept at a constant level by suitable means. When said roller *c* rotates at a predetermined speed, small particles of the liquid adhere to it within the shallow groove *f* by reason of the cohesive properties of the liquid, and are flung around with the roller in the shape of a thin sheet or film of liquid. It is obvious that the quicker the roller rotates the more liquid it will take up within its crevice so that the film always receives the correct amount and it is immaterial whether the arrangement works, within practical limits, at high or low speed. The fine film of liquid passes up with the roller until its surface unites with the surface of the moving film *a* on account of the capillary properties of the liquid at the moment of contact, and remains in perfectly even contact with the film band for the duration of the common forward travel of the two surfaces until, at the departure of the film band from the roller, the thin sheet of liquid breaks away. The tension required to maintain the film in even contact with the roller varies according to the kind and material of the film or band, and it is for this reason that the regulatable tensioning device represented by the weighted roller *d* is employed.

The degree of moisture imparted to the surface of the film *a* depends on the rotating speed of the roller *c* in relation to the speed of travel of the film. At the edges, where on account of the direct contact of the film with the metal of the roller no even application of the liquid is able to take place, the liquid spreads by itself from the central portions of the film after the latter has left the roller.

In the case of perforated bands of material, such as cinematographic film, the arrangement may be such as to provide a supporting ridge or the like along the margins of the roller on both sides of the film perforations, thus preventing the film creasing or breaking along these of its weakest portions.

What I claim is:—

1. A device for applying liquid to cinematographic film bands comprising in combination, a roller wheel supported for free rotation in a bath of the liquid and having a shallow circumferential depression or groove of a width slightly less than the width of the bands and deepened marginally between lateral ridges of its peripheral surface; guide rolls by which the bands reeled from one point to another are trained over an arc of the wheel with their margins contacting said ridges and their effective film surfaces bridging said groove in exposure to the liquid picked up and carried therein by capillary action with rotation of the wheel; means for reeling the bands from said one point to another; and means for regulating the tension of the bands upon said wheel, the latter being rotated by friction thereon of the moving bands and the quantity of liquid picked up thereby and applied to the bands being variable directly with the speed of reeling the same.

2. In a device for applying surface treating liquid to one side of a film band, a roller wheel supported for free rotation in a bath of the liquid and having a circumferential depression or groove of shallow depth and of width only slightly less than the width of the band in which the liquid is picked up and carried by capillary action with rotation of the wheel effected by the band passing thereover in reeling from one point to another, and guide-rolls training the band upon the wheel in bridgement of its said depression so that the effective film surface will be exposed to the liquid therein without contacting the wheel surface, the quantity of liquid picked up by the wheel and so applied to the band being variable with the speed of the moving band.

3. A device for applying surface treating liquid to one side of film bands comprising in combination, a roller wheel supported for free rotation in a bath of the liquid and having a shallow circumferential depression or groove of a width slightly less than the width of the bands and lateral marginal ridges; guide-rolls by which the bands reeled from one point to another are trained over an arc of the wheel with their margins contacting said ridges and their effective film surfaces bridging said grooves in exposure to the liquid picked up and carried therein by capillary action with rotation of the wheel; means for reeling the bands from said one point to another; and means for regulating the tension of the bands upon said wheel, said means including a weighted roller suspended by depending loops of the bands; said wheel being rotated by friction thereon of the moving bands while the quantity of liquid picked up thereby and applied to the bands will be variable directly with the speed of reeling the latter.

4. In a device for applying liquid to film bands according to the preceding claim, electric contacts arranged above and below the weighted roller and adapted to actuation thereby for closing the indicator circuit whenever the tension on the moving band becoming slack or excessive lowers or raises said roller thereagainst.

5. In a device for applying a treating liquid to one side of a film band, a roller wheel supported to rotate freely in a bath of the liquid and having a peripheral depression of shallow depth and of a width only slightly less than the width of the band over which the latter is passed in reeling from one point to another, said band being trained upon an arc of the wheel with its intermediate portion bringing said depression so as to be directly exposed to the liquid lifted up and carried therein by capillary action upon rotation of the wheel; means for reeling the band from said one point to another and a yielding tensioning device for maintaining the required tension of the band on said wheel, the latter being rotated by friction of the band in moving thereagainst.

6. A device for applying a treating fluid to one side of bands or strips of material comprising in combination, a roller wheel supported for free rotation in a bath of the liquid and having a shallow circumferential depression or groove of a width slightly less than the width of the bands and deepened marginally between lateral ridges of its peripheral surface; guide-rolls by which the bands reeled from one point to another are trained over an arc of the wheel with their margins contacting said ridges and their intermediate portions bridging said groove in exposure to a film of liquid picked up and carried therein by capillary action with rotation of the wheel; means for reeling the bands from said one point to another; and means for tensioning the same on the wheel, the latter being driven by friction of the moving bands thereagainst.

In testimony whereof I affix my signature.

JOHANN JACOB FRIEDRICH STOCK.