

Jan. 22, 1952

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2,583,267

APPARATUS FOR CONTINUOUSLY APPLYING A PRESCRIBED AMOUNT
OF LIQUID COMPOSITION TO A MOVING LINEAR MATERIAL

Original Filed Dec. 22, 1948

2 SHEETS—SHEET 1

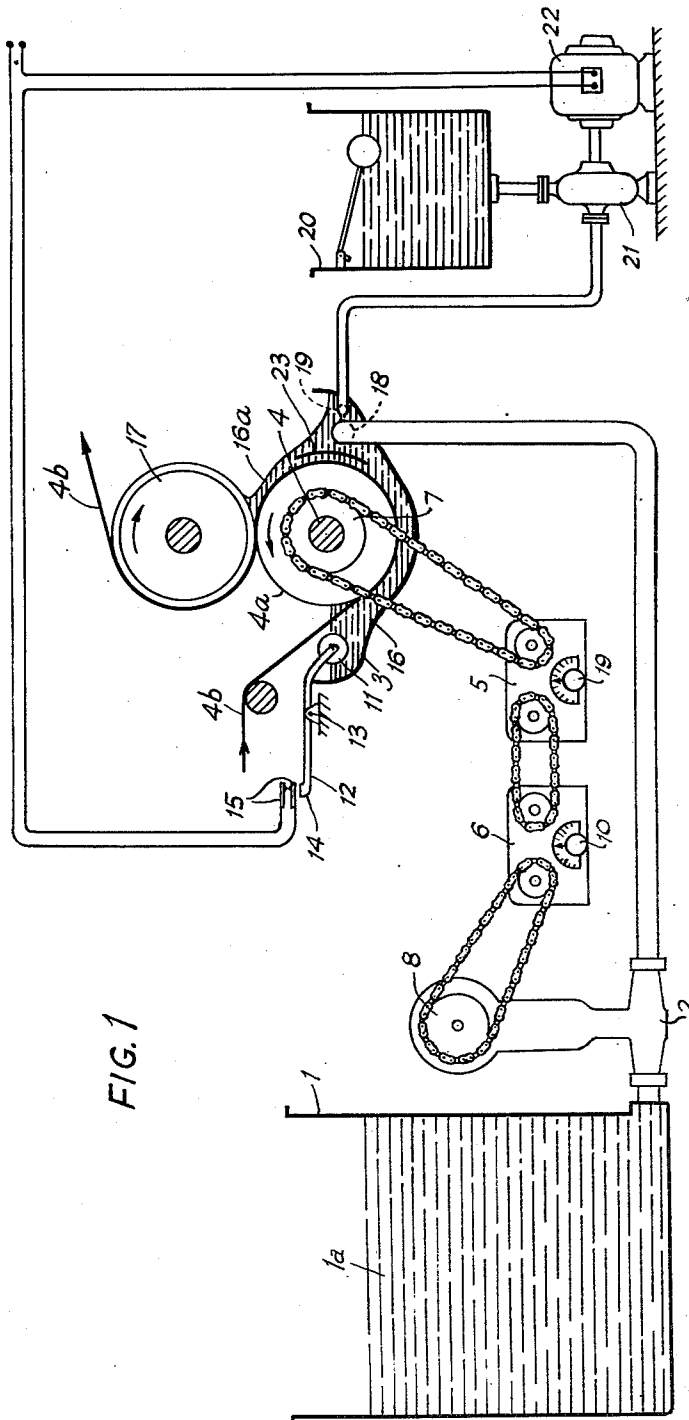


FIG. 1

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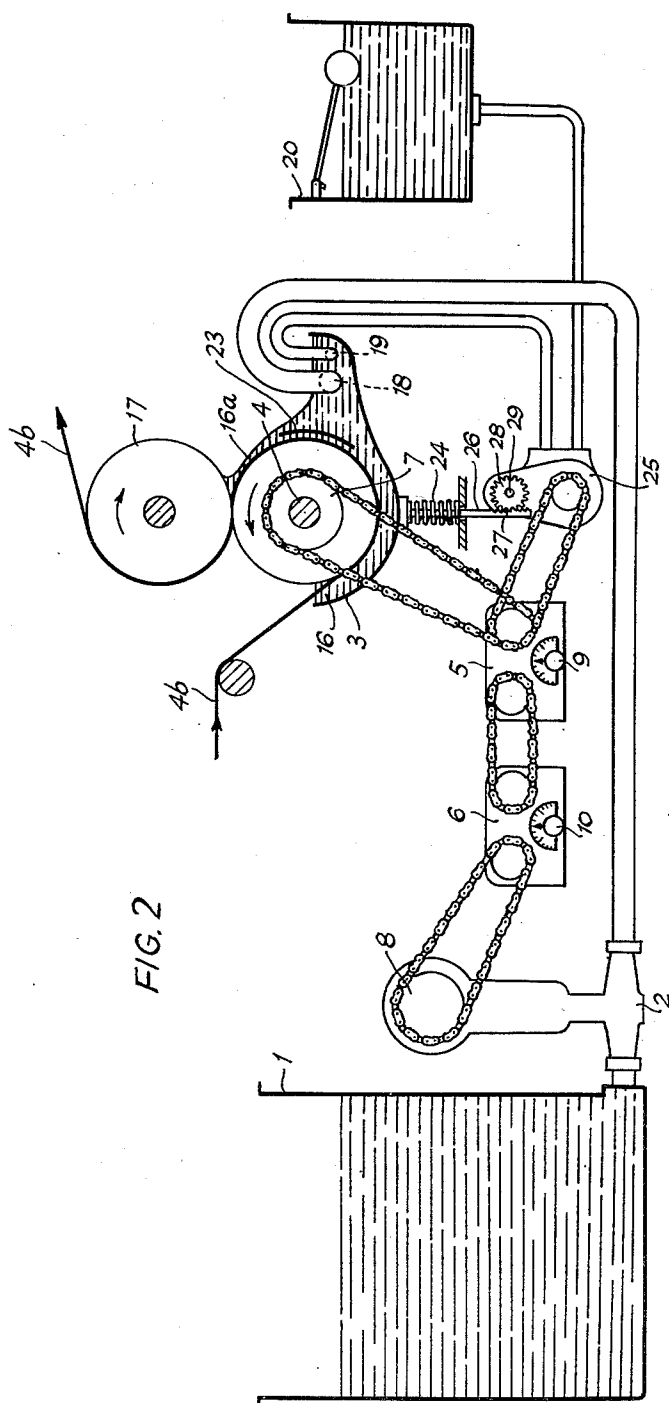
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2 SHEETS—SHEET 2



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2,583,267

APPARATUS FOR CONTINUOUSLY APPLYING
A PRESCRIBED AMOUNT OF LIQUID COM-
POSITION TO A MOVING LINEAR MATE-
RIAL

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Original application December 22, 1948, Serial No.
66,596. Divided and this application Novem-
ber 23, 1949, Serial No. 129,046. In Great
Britain December 30, 1947

4 Claims. (Cl. 91-46)

1

This invention relates to improvements in ap-
paratus for continuously applying to a moving
length of material such as a sheet, rope, thread,
ribbon, web, filament or assemblage of threads
or filaments, a specified weight per unit length
of a substance, in the form of a solution, dis-
persion, emulsion, melt or other fluid (herein-
after termed "fluid" or "liquid composition").
The invention applies to those continuous pro-
cesses in which the "take up" or amount of sub-
stance removed by the material from a bulk of
fluid presented to it depends upon variables such
as the nature of the material, the properties of
the fluid and the characteristics of any mecha-
nism by which the fluid is being applied to the
material. Further, the invention is concerned
with such processes either where the whole of
the fluid taken up by the moving material is
ultimately retained by it or where certain con-
stituents after being taken up are removed by
evaporation or other means. The application of
the fluid to the material may be effected in any
manner in which the "take-up" substance is
dependant upon at least one variable as afore-
said for example by passing the material through
a bath of the fluid as is commonly done in known
continuous processes.

Continuous processes to which the invention
will apply are exemplified by the sizing of textile
materials such as yarns or fabrics and of paper,
the filling of textile materials and of paper by
the addition of adhesives or other substances
and the dyeing of textile materials. It is im-
portant in such processes to ensure that a spec-
ified quantity or quantities of the applied sub-
stance or substances per unit length is or are
ultimately retained by the moving material uni-
formly along its length. Such an objective can-
not at present be achieved with certainty when
the take-up is a function of some variable, such
control as is achieved being by trial and error
and from results ascertainable only by subsequent
test of the treated material.

The object of our invention is to regulate auto-
matically the weight of the component or com-
ponents of the fluid which are ultimately re-
tained by unit length of the moving material,
so that this weight per unit length remains sub-
stantially constant in spite of variations in the
nature of the material, the properties of the
fluid and the characteristics of the machine being
used for the application of the fluid to the ma-
terial.

The invention comprises apparatus for apply-
ing to a continuously moving sheet of material

2

a prescribed weight or amount per unit length
of a substance and comprising a reservoir, a
fluid containing the substance in the reservoir
and means for applying the fluid from the
reservoir to the material including means for
varying the amount of substance so applied
characterised by means for supplying the sub-
stance to the reservoir at a rate predetermined
by the said prescribed weight and by the rate
of movement of the material and means respon-
sive to change of weight of fluid in the reservoir
operably connected to the said means for varying
the amount of substance applied to the material
so as thereby to correct any deviation from the
prescribed rate of application of the substance.

The "weight of fluid" referred to above may be
ascertained by direct measurement of weight or
by an indirect measurement as from change of
volume, depth, pressure, etc.

In one embodiment of the invention we supply
to a reservoir in some suitable fluid form while
a unit length of material is passing, precisely the
amount of those components which it is required
should be ultimately retained by unit length of
moving material and we provide means for en-
suring that unit length of moving material is
forced on the average to accept from the reservoir
an amount of these components, equal to that
which has been supplied. Firstly, we provide
some convenient method of detecting any de-
parture from the correct rate per unit length
of acceptance of the solids or liquids by the mov-
ing material without having to examine the
treated material, i. e., by detecting the corre-
sponding change in the weight or volume of
liquid in the reservoir. Secondly, having de-
tected this departure, we arrange that it is
utilised to effect some compensating change in
a variable controlling the take-up such as a
property of the bulk of fluid or a machine char-
acteristic, such as the pressure of a squeezing
roller, or a property of the moving material it-
self, such as its water content before applica-
tion. The result is therefore, that after a certain
time which is necessary for the adjustment to
take place, the material will take up the sub-
stance at the required rate. It is one purpose
of our invention to keep this time for adjust-
ment as short as possible.

The two examples of our invention which we
shall describe refer to its application to sizing of
warps. In these examples, the control is ef-
fected by altering a property of the fluid which
is applied to the material.

3

In the accompanying drawings:

Fig. 1 is a diagrammatic sectional view showing one example of a warp sizing machine made in accordance with the invention.

Fig. 2 is a modified construction of a warp sizing machine according to the invention.

The first example of our invention, illustrated in Fig. 1, is an "on-off" type of regulator applied to a sizing machine for warps. The object is to deposit a size solution (the fluid) on to a moving sheet of warp so that the warp shall acquire a predetermined percentage by weight of the solids (the "dissolved" substance). The vessel or container 1 contains the stock liquor 1a of a predetermined concentration which is such that if it were taken up by the warp in an undiluted state the resulting percentage of solids found on the warp would be greater than desired even when allowance is made for variation with time of the properties of the fluid or the machine or the warp which would tend to reduce the take-up of solids by the warp. To obtain the required percentage of solids on the warp it is therefore always essential to use the fluid in diluted form. A metering pump 2 is arranged to pump the stock liquor from vessel 1 to the reservoir or size box 3 at such a rate that the amount of solids delivered to the size box while a certain length of warp is drawn through the size box is equal to the amount of solids which it is desired that this length of warp shall acquire. This is conveniently done by using a pump of the piston or plunger type which delivers a definite volume of liquor for one revolution of the pump shaft, and, by driving the pump from a rotating member of the machine, such as the shaft 4 of the combined immersion and lower squeezing roller 4a which carries the warp 4b and therefore rotates at a speed proportional to the rate at which the warp is being drawn through the machine. In order to enable the same concentration of stock liquor to be conveniently used for a range of percentages of solids on the warp and also for a range of warps having different weights per unit length, two positively and continuously adjustable gears 5 and 6 are inserted between the driving wheel 7 of the machine and the driven wheel 8 on the pump shaft. For convenience, the speed adjusters 9 and 10 on these gears are calibrated respectively in the percentage of solids required on the warp and in the ratio of the number of threads in the warp sheet to the count of the threads. The reservoir or size box 3 is of small capacity so as to reduce the time for adjustment previously referred to and is fitted with a floating roller 11 attached to one end of a lever 12 fulcrumed at 13. The other end 14 of this lever closes a pair of electrical contacts 15 when the level of the fluid 16 in the box falls below a predetermined level. The sheet of warp is drawn through the fluid by passing it round the lower roller 4a and then through the nip formed between this lower roller and a heavy upper roller 17, where much of the fluid is held back and squeezed off as shown exaggeratedly at 16a. The warp, after being loaded with the fluid, passes on to a dryer (not shown). The fluid from the pump 2 is delivered into the box through a slot in the horizontal pipe 18 which runs across the full width of the box. An adjacent pipe 19, running parallel with 18, has a slot which faces the slot in 18 as shown, and delivers hot water into the box to dilute the fluid as required. This water is pumped from a tank 20 by means of a pump 21 which is electrically driven by means of the

4

motor 22. The incoming water and stock liquor meet in the space between the two delivery pipes and become intermixed by their confluence and the circulating action of the fluid in the box produced by the rotation of the squeezing roller 4a, movement of the warp, return flow of fluid from the nip of the rollers and the action of baffle plate 23. If the depth of fluid in the box becomes less than the specified depth, the floating roller 11 falls, causing the contacts 15 to close and the motor 22 to operate so that water is pumped into the reservoir or size box 3 until the depth of fluid is again equal to the specified depth. As dilution of the fluid results in a reduced take-up of solids by the warp, an equilibrium condition is reached when, despite any drift with time in the properties of the fluid, the machine or the warp, the concentration of the fluid in the box is such that the desired percentage of solids is being taken up by the warp.

The second example of our invention, also applied to a sizing machine, is illustrated in Fig. 2. This example embodies most of the components illustrated in Fig. 1 and such components are given the same reference characters. It differs from the first sample in that the water for diluting the fluid instead of being supplied intermittently by the electrically driven pump 21 is continuously supplied to the reservoir or size-box at a rate which is approximately proportional to the amount by which the weight of fluid in the size-box is less than a predetermined amount. The arrangements for storing the stock liquor and pumping it over to the size box are similar to those used in the first method but the size box 3 is supported by a helical spring 24. The hot water is pumped from the tank 20 by means of a pump 25 which is driven from the driving wheel 7 at a speed proportional to the speed of the roller 4a. The incoming water and stock liquor meet in the space between the two delivery pipes 18 and 19 and become intermixed by their confluence and by the circulating action of the fluid in the size-box produced by the rotation of the roller 4a and the action of the baffle plate 23. If the weight of fluid in the size-box becomes reduced, the spring 24, which supports the size-box, extends and a rod 26 which passes down the centre of the spring and which is secured to the underside of the size-box, rises. The rod 26 is provided at its lower end with a row of teeth 27 forming a rack which engages with a pinion 28 which is fixed to a shaft 29, the rotation of which controls the rate of delivery of the pump and hence controls the amount of water added to the fluid for a given length of warp passing through the machine. The adjustment is arranged so that when the weight of fluid in the box becomes reduced the pinion 28 is rotated in the direction for increasing the rate at which water is pumped to the box. It will be seen that, provided the mechanism is designed so that, for the full range of adjustment of the pump control, the level of fluid in the box remains within workable limits, the mechanism above described automatically adjusts the delivery of the pump 25 so that despite any drift with time in the properties of the fluid, the machine or the warp, the concentration of the fluid becomes that which is required to load the warp with the correct percentage weight of solids.

The invention is obviously not limited to all the details of the examples above described in

so far as they may be varied without departing from the nature of the invention.

For instance there are other variable factors than those used in the specific examples which might be used to control the weight of substance per unit length applied to the material. As for example other variable properties for the fluid besides concentration include temperature, viscosity, wetting power and density. Some of the variable factors of the machine besides the pressure on the doctor knife or squeezing rollers are, speed of pick up roller, depth of immersion, speed of running. The absorbptive capacity of the material itself may also be varied by altering such factors as its moisture content, its hardness, its temperature or its wettability.

This application is a division of application Serial No. 66,596, filed December 22, 1948.

We declare that what we claim is:

1. Apparatus for continuously applying a prescribed amount of liquid composition to a moving linear material and wherein the amount of take-up of the composition by the material varies, comprising a reservoir, a container for the liquid composition connected with said reservoir, a pump in the connection between the reservoir and the container for supplying the liquid composition to the reservoir, a second container for a diluent connected with the reservoir, a pump in the connection between the diluent container and the reservoir for supplying the diluent to the reservoir, the liquid composition pump supplying a constant regulated prescribed amount of the composition to the reservoir, the diluent pump supplying a variable amount of the diluent to the reservoir, a control member movably mounted externally of the reservoir and adjacent thereto and reacting in response to a change of the amount of the liquid in the reservoir resulting from the varying take-up of the composition by the material, said member being operatively connected with the second mentioned pump to control the variable supply of the diluent to the reservoir, so that as the material moves in contact with the liquid in the reservoir, and as the

result of the varying take-up of the composition by the material, more or less of the liquid in the reservoir will be taken up, whereby the overall application of the liquid composition to the moving material is substantially of the prescribed amount and uniform throughout the length thereof.

2. The apparatus as defined in and by claim 1 wherein the control member is a float member movably mounted externally of the reservoir and adjacent thereto and operatively connected with the second mentioned pump to control the variable supply of the diluent to the reservoir.

3. The apparatus as defined in and by claim 1 wherein the control member is a pivotally mounted float, the mounting being externally of the reservoir and adjacent thereto, a motor for driving the second mentioned pump, and an operative electrical connection including a switch between the float and the motor, and the float operating said switch to control the variable supply of the diluent to the reservoir.

4. The apparatus as defined in and by claim 1 wherein the reservoir is movable and carries therewith a control operating member which cooperates with the control member that is movably mounted externally of the reservoir and adjacent thereto, and which control member is operatively connected with the second mentioned pump to control the variable supply of the diluent to the reservoir when the reservoir and the first mentioned member move.

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