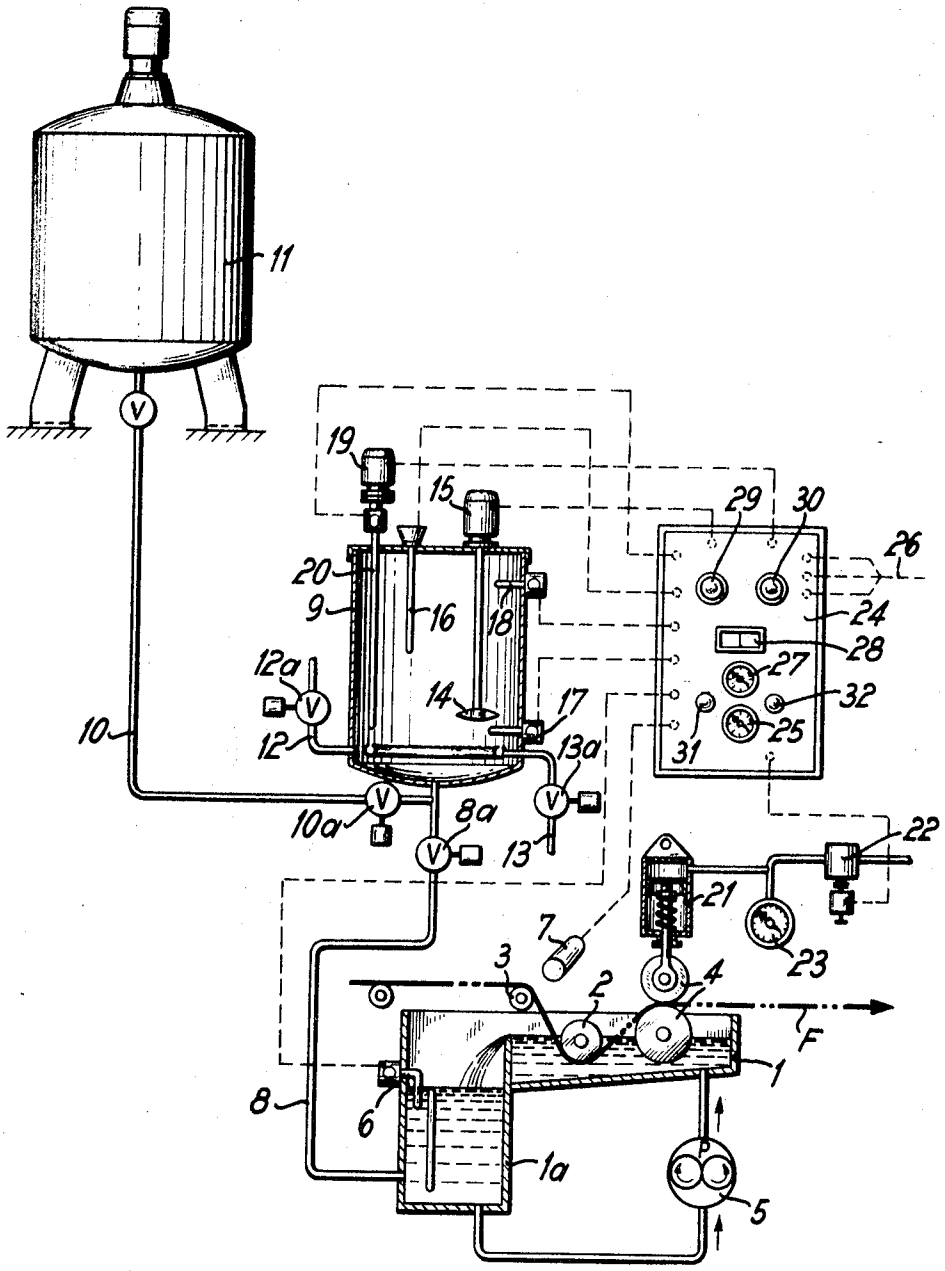
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METHOD FOR CONTROLLING THE FILLING OR WEIGHTING ABSORPTION OF A FIBROUS MATERIAL

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METHOD FOR CONTROLLING THE FILLING OR WEIGHTING ABSORPTION OF A FIBROUS MATERIAL

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Int. Cl. B05c 11/10
U.S. Cl. 117—102 L 4 Claims

ABSTRACT OF THE DISCLOSURE

Method of controlling absorption of a filling agent by a fibrous material includes applying a constant excessive concentration of filling agent to the fibrous material; passing the thus-filled fibrous material between a pair of squeeze rollers and simultaneously increasing the bearing pressure of the squeeze rollers to a given optimum value in dependence upon the amount of filling agent absorbed; and, after the optimum bearing pressure is attained, varying the concentration of the filling agent to thereby regulate the absorbed amount; and apparatus for carrying out the foregoing method.

This application is a continuation of application Ser. No. 758,477, filed on Sept. 9, 1968, now abandoned, and relates to method and apparatus for controlling or regulating the filling or weighting absorption of a fibrous material.

To control the filling or weighting absorption of a fibrous material, it has been known heretofore to vary either the bearing pressure of the squeeze rollers between which the fibrous material is passed or the concentration of the filling or weighting agent in dependence upon the measured filling or weighting absorption. When controlling the filling or weighting absorption by varying the bearing pressure of the squeeze rollers, it has been found, however, that the bearing pressure of the squeeze rollers cannot be increased arbitrarily. On the one hand, consideration must be given to the fact that with a squeeze pressure that is too high, burls, nubs or snarls can be impressed and crushed or crumpled. The surface of the squeeze rollers can be damaged and the nip or squeeze gap between the rollers can be so widened that an undesired high wet-stretching of the fibrous material being processed thus occurs. Furthermore, in such a case, it is essential that a filling operation be performed, which unnecessarily burdens the running of the machine. On the other hand, consideration must also be given to the fact that, after exceeding a given limit of the squeeze pressure, upon further increase in the squeeze pressure, the squeeze effect will vary only insignificantly until it will finally remain unchanged. From these considerations there results an optimum value for the squeeze pressure. In order to ensure a sufficiently wide control range of the bearing pressure of the squeeze rollers below this optimum value when controlling the filler absorption by varying this bearing pressure, it is necessary to select the concentration of the filling agent at a somewhat lower value than is desirable for optimum squeezing. However, such a step is disadvantageous in that the drying device through which the thus-filled fibrous material subsequently passes must apply greater power in order to remove the increased moisture content from the fibrous material. On the other hand, the control of the filling absorption by varying the concentration of the filler agent has the disadvantage that, initially, the squeeze pressure must be preselected. In order

to maintain the drying power output of the drying device, to which the filled fibrous material is thereafter passed, at the smallest possible value, it is therefore desirable to adjust the bearing pressure of the squeeze rollers to a given optimal value. Heretofore, attention has been directed for this purpose to experimental and empirical values, with due consideration having to be given to the type of fibrous material being processed, especially the filler absorption capacity thereof. With the new types of fibrous material, particularly the man-made fibers, this automatically necessitates the maintenance of an excessive safety zone or margin which can be reduced only in the course of time and on the basis of accumulated experience. Naturally, in the time necessary for obtaining the required knowledge, considerable loss in processing activity is sustained.

It is accordingly an object of my invention to provide method and apparatus for controlling the absorption of filler by a fibrous material which avoid the foregoing disadvantages of the heretofore known methods and apparatus of this general type.

With the foregoing and other objects in view, I provide method of controlling the absorption of filler agent by a fibrous material which comprises applying a constant excessive concentration of filling agent to the fibrous material; passing the thus-filled fibrous material between a pair of squeeze rollers and simultaneously increasing the bearing pressure of the squeeze rollers to a given optimum value; and, after the optimum bearing pressure is attained, varying the concentration of the filling agent.

The servicing personnel are thus not advised of any experimental data or values, but rather, they begin the processing of the fibrous material initially with a filling material concentration which, based upon experience even for optimum value of the squeeze roller bearing pressure, will nevertheless produce too great a filling of the fibrous material. This procedure is followed because excessive filling is generally considerably less damaging in the further processing of the fibrous material than is a filling that is too low for the fibrous material. Then, the bearing pressure of the squeeze rollers is increased in dependence upon the filling absorption for as long as a further increase in the bearing pressure will only result in an insignificant change in the filling absorption. The optimum value of the bearing pressure is simultaneously attained therewith. Thereafter, the concentration of the filling agent can be varied in a conventional manner in accordance with the filling absorption. During this control operation it can be advantageous, in accordance with the invention, to vary the bearing pressure in a conventional manner in accordance with the flowthrough rate or throughput of the fibrous material, when the throughput is required to be changed, for example by a switchover to slow or creeping motion.

The apparatus for carrying out the method of my invention comprises means for varying the bearing pressure of the squeeze rollers, means for varying the concentration of the processing medium supplied to the processing vessel, means for measuring the filling absorption in the fibrous material to which the filling agent is applied, and switch means connected between the measuring means, on the one hand, and the bearing pressure varying means and the concentration varying means, on the other hand, for initially increasing the bearing pressure to a given optimal value thereof in dependence upon the measured value of the filling absorption, and thereafter automatically controlling the concentration to an adjustable nominal value in dependence upon the measured value of the filling absorption.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described

herein as method and apparatus for controlling the filling or weighting absorption of a fibrous material, it is nevertheless not intended to be limited to the details shown, since various modifications may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The invention, however, together with additional objects and advantages thereof will be best understood from the following description when read in connection with the accompanying single figure of the drawing which shows diagrammatically the apparatus for carrying out the method of controlling the absorption of filling agent by a fibrous material.

Referring now to the figure, there is shown a processing vessel **1** containing a filling or weighting agent, in the instant case a sizing solution, through which a fibrous material, a warp thread bunch F in the case at hand, is passed by means of immersion rollers **2** in a conventional manner. Furthermore, the thread bunch F is conveyed, in a manner well known in the art, over deflecting rollers **3** and between a pair of squeeze rollers **4**. In the processing vessel **1** containing the sizing, there is provided an overflow vessel **1***a* in a construction heretofore well known, the sizing being supplied by means of a pump **5** continually in excess quantity to the processing sizing vessel **1**. A measuring or test probe **6** is disposed within the overflow vessel **1***a* to establish the fluid level therein which, after dropping below a predetermined level of the bath, achieves renewed filling of the overflow vessel **1***a*. Furthermore, the deflecting or diverting roller **3** is furnished with a measuring or testing device for establishing the length of the thread bunch which has passed by the same. In the embodiment illustrated in the figure, this lentgh measuring device includes a pulse generator **7** which generates a pulse that affects an indicating device which registers the length in suitable units of the fibrous material which has passed by. To provide a refill for the expended sizing liquid, the overflow vessel **1***a* is connected through a conduit **8**, in which there is provided a valve **8***a* which is either operable by hand or by remote control, with a metering and mixing vessel **9**. A source bath or liquid of constant concentration is supplied from the heating or supply vessel **11** to the metering and mixing vessel **9** in a conventional manner through the conduits **10** and the valve **10***a* disposed therein. In order to achieve the desired concentration in the sizing vessel **1**, a diluent or diluting liquid is supplied to the metering and mixing vessel **9**, moreover, through the conduit **12** in which a control valve **12***a* is connected. To ensure the desired bath temperature, the metering and mixing vessel **9** is provided with direct steam heating by any suitable conventional means, the supplied heating steam being directly blown into the sizing solution contained in the metering and mixing vessel **9** through a conduit **13** in which a valve **13***a* is connected. As can be seen in the figure, a stirring device **14** extends into the metering and mixing vessel **9** and is driven by a motor **15** located outside the vessel, so as to intimately intermix the source bath with the diluent. Additionally extending into the metering and mixing vessel **9** is a temperature sensing element **16** as well as a liquid level test probe having contacts **17** and **18** for respectively sensing a minimum and maximum liquid volume located in the metering and mixing vessel. There is also provided a test probe **20** adjustable by a motor **19** and having as its function the determination, in a conventional manner, of the mixing ratio of the source sizing, supplied from the heating or supply vessel **11**, to the diluent supplied through the conduit **12**. The bearing pressure of the squeeze rollers **4** is produced by conventional means through a pneumatically driven piston in a cylinder **21**. A control valve **22**, activated manually as well as by remote control, is provided for adjusting the bearing pressure of the squeeze rollers **4**. The bearing pressure of the squeeze rollers **4** can be read directly from a manometer **23** connected in the pneumatic line terminating in the cylinder **21**.

All of the sensing and control leads connect with a switching device **24**. A main switch **25** is provided in the switching device **24** and connects the entire system through a line **26** with the utility line. There is furthermore provided a selector switch **27** as well as an indicating instrument **28** which are connected to the pulse generator **7** and indicate the length of the warp thread bunch F that has run past the pulse generator **7**. In addition, two push buttons **29** and **30** are provided by means of which the adjusting motor **19** for the test probe **20** can be switched on in one or the other rotary direction so as to move the test probe **20** in an upward or downward direction respectively. Therewith, the respective push button is simultaneously illuminated, and quite independently of the fact whether the switching on of the motor **19** is effected by actuation of the respective push button or automatically. Two signal lamps **31** and **32** of different color, if necessary, are also provided, one of which being able to be switched on by the measuring probe **6** and the other by the indicator device **28**. Since it is a relatively simple matter for an electrician to suitably wire the foregoing components of the switching device **24** and since it is believed that a showing of the wiring of those members in the figure might somewhat obliterate other important details and might lead to possible confusion, the exact wiring of the components to one another is not shown in the drawing.

The method of my invention is carried out with the illustrated apparatus in the following manner.

Before the beginning of the sizing operation, the sizing or processing vessel **1** and the overflow vessel **1***a* are filled with a sizing solution of excessive concentration. If, for example, a sizing concentration of 10% for the sizing vessel **1** is considered to be probably or presumably correct, the sizing vessel **1** is initially filled with a 12 or 15% sizing solution. The selector switch **27** is then first set to control the bearing pressure of the squeeze rollers **4**. For this purpose, the length of the thread bunch F which has run through the apparatus is compared with the consumption of sizing liquid in the sizing vessel **1** in a manner corresponding, for example, to that of the Swiss Pat. 372,020. Since the sizing concentration in the vessel **1** is exceeded, the signal "Processing Liquid Consumed" is given by the liquid level measuring probe **6** sooner than the measured length predetermined for the nominal amount of sizing sensed by the pulse generator **7** appears at the indicating instrument **28**. In this case the indicator lamp **31** is switched on by the test probe **6** and is illuminated, thereby indicating that too much sizing has been applied to the thread bunch F. Simultaneously, the switching device **24** issues an adjusting pulse to the valve **22** to increase the bearing pressure of the squeeze rollers **4**. This operation is repeated until no essential change in the length is produced any longer for repeated indications at the measuring device **28**. The value of the bearing pressure of the squeeze rollers **4** indicated at the manometer **23** then corresponds to the optimum value of the squeezing effect or action.

Depending upon the composition of the squeeze rollers **4** and of the material being processed, the optimum value of the bearing pressure can, however, also be lower than the optimum value of the squeeze effect or action established in the aforedescribed manner. As has been mentioned before, consideration must also be given, with regard to the optimum value of the bearing pressure, to the fact that for squeezing pressure which is too high, burls, nubs or snarls can be impressed and crushed or crumpled, and with corresponding ring travellers on the rollers the roller surface can become damaged, and so forth. In case the thereby allowable optimum value of

the bearing pressure is not known beforehand, the material to be processed, in this case the warp thread bunch F, must be inspected while the bearing pressure of the squeeze rollers **4** is being increased. Otherwise, it is sufficient to inspect the manometer **23** and to interrupt the control operation for increasing the bearing pressure of the squeeze rollers **4** when attaining the indicated optimum value at the manometer **23**.

When the optimum value of the bearing pressure of the squeeze rollers **4** is attained, the selector switch **27** is adjusted to the position "Concentration Control" which then acts to change the concentration of the sizing solution supplied to the sizing or processing vessel **1** through the conduit **8**. The following operation then takes place.

It is assumed that in the heating or supply vessel **11** a 20% source bath is always produced which mixes with the diluent supplied through the conduit **12** in the metering and mixing vessel **9** in such a ratio that the useful sizing supplied through the conduit **8** attains the concentration corresponding to the degree of sizing of the warp thread bunch F. For this purpose, the valve **10***a* is initially opened and so much of the source bath is supplied to the metering and mixing vessel **9** from the heating or supply vessel **11** until the adjustable test probe **20** suitably responds. The valve **10***a* is then closed and the valve **12***a* is opened, which then permits the metering and mixing vessel **9** to be filled until the maximum contact **18** of the liquid level measuring device suitably responds thereto.

Since, with the aforedescribed method of my invention, the useful sizing supplied through the conduit **8** to the sizing vessel **1** should initially exhibit an excessive concentration so that even for optimum bearing pressure of the squeeze rollers **4** the test probe **6** should respond sooner than the measuring device **28** registers the nominal length of the thread bunch passing through the apparatus, the indicator lamp **31** connected with the test probe **6** will become illuminated sooner than the indicator lamp **32** connected with the measuring device **28** also after the selector switch **27** is switched over to the position "Concentration Control." Simultaneously, adjusting pulses are passed from the switching device **24** to the motor **19** for the probe **20** for a period of time until the indicator lamp **32** also becomes illuminated i.e. until the value of the nominal measured length of the thread bunch passing through the apparatus is also registered at the measuring device **28**. Accordingly, the adjusted level of the probe **20** is higher the greater the time difference between the response of the test probe **6** and the attainment of the value of the nominal measured length at the measuring device **28**. The deeper the adjustable probe **20** is immersed in the metering and mixing vessel **9**, the less source bath is supplied through the conduit **10** so that all the more diluent is supplied through the conduit **12** to fill the metering and mixing vessel **9**. The concentration is thus the more sharply reduced the deeper the adjustable probe **20** is immersed. If it should happen thereby that the concentration should drop slightly below the nominal value so that the indicated measured length of the measuring device **28** attains its nominal value sooner than the test probe **6** responds, the indicator lamp **32** then is illuminated first. Simultaneously, adjusting pulses are transmitted to the adjusting motor **19** for the probe **20** in a direction so that the probe **20** is immersed less deeply in the vessel. Also here the adjusting pulses are again generated during the entire time difference between the response of the meter indicator of the measuring device **28** and the response of the test probe **6**.

In principle then, according to the method of my invention, the amount of filling agent absorbed by a fibrous material from a solution of the filling agent is regulated to a predetermined so-called nominal or datum value whereby the specific amount of filling agent corresponding to the nominal or datum value remains in the fibrous material. Thus, for example, in filling a thread bunch with a starch sizing, the quantity of sizing remaining in the thread bunch is maintained constant at a specific value corresponding to the characteristics of the thread bunch fibers and the use to be made thereof. It is obvious that the absorbed quantity of sizing, on the one hand, is dependent upon the concentration of the sizing solution, i.e. upon the ratio of water to the starch sizing contained therein and, on the other hand, upon the amount of sizing solution remaining in the thread bunch. It should be clear that the greater the bearing pressure applied by the squeeze rollers, the smaller is the amount of sizing absorbed. Furthermore, the absorbed amount of sizing is also dependent upon the concentration of the sizing solution. The higher the concentration, i.e. the greater the quantity of sizing contained in the water, the greater is the amount of sizing remaining in the thread after the water is removed therefrom. Since the amount of squeezing action effected by the squeeze rollers is approximately known, the concentration of the treating agent, i.e. the sizing solution, can be predetermined approximately in order to obtain a specific filling absorption, i.e. to size the fibrous material to a specific degree.

According to the method of the invention, therefore, I employ an excessive concentration of the filling agent, i.e. of the sizing solution, and initially maintain that concentration at a constant value. Since the measuring device which measures the amount of filling absorbed, naturally indicates an excessive filling absorption quantity, the bearing pressure of the squeeze rollers is first increased automatically in dependence upon this indicated filling absorption quantity until the optimum value of the bearing pressure is attained, which can be indicated, for example, at the device for measuring the amount of filling absorbed, that measuring device indicating no further decrease in the amount of filling agent absorbed. The concentration of the filling agent is thereafter reduced in dependence upon the measuring device reading or indication of the amount of filling agent absorbed until the actual value indicated by the measuring device corresponds to the nominal or datum value of the desired filling absorption, so that the fibrous material has thus actually absorbed that amount of filling agent that it should have absorbed.

Thus, in the method of my invention as well as in the apparatus for carrying out the method, there is employed a genuine regulating system with an actual closed regulating circuit containing an actual value indicator and a nominal or datum value producer or indicator, as is known particularly from regulating methods in electrical technology.

As has been repeatedly noted, the invention is not limited to the particular embodiment disclosed hereinbefore and illustrated in the drawing. For example, to establish the actual value of the filling absorption, instead of comparing the measured length of the thread bunch F passing through the apparatus with the consumption established at the fluid level test probe **6**, other testing or measuring methods can be employed to provide an accurate reference point for the actual value of the sizing absorption by the thread bunch F.

I claim:

1. Method of controlling absorption of a filling agent by a fibrous material, which comprises applying a constant excessive concentration of filling agent to the fibrous material; passing the thus filled fibrous material between a pair of squeeze rollers and simultaneously increasing the bearing pressure of the squeeze rollers to a given optimum value in dependence upon the amount of filling agent absorbed by the fibrous material; and, after the optimum bearing pressure is attained, varying the concentration of the filling agent to thereby regulate the amount absorbed by the fibrous material.

2. Method according to claim **1** wherein the bearing pressure of the squeeze rollers is varied by varying the rate at which the fibrous material is passed through the nip between the rollers.

3. Method according to claim **1** wherein the filling

agent is applied to the fibrous material by passing the latter through a bath of the filling agent.

4. Method according to claim 1 wherein the concentration of the filling agent is reduced after the optimum bearing pressure is attained.

References Cited

UNITED STATES PATENTS

2,887,087	5/1959	Jones	118—7
2,953,476	9/1960	Armstrong	118—7 X
3,292,573	12/1966	Jones	118—7
3,425,861	2/1969	Jones	117—102 L

FOREIGN PATENTS

614,045	2/1961	Canada	118—7
654,178	6/1951	Great Britain	118—7
907,529	10/1962	Great Britain	118—7

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117—102 A, 102 R; 118—7

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,737,338 Dated June 5, 1973

Inventor(s) HANS KABELITZ

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, Line 12,

"S 111,702" should read --S 111 702 VIIa/8a--

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents