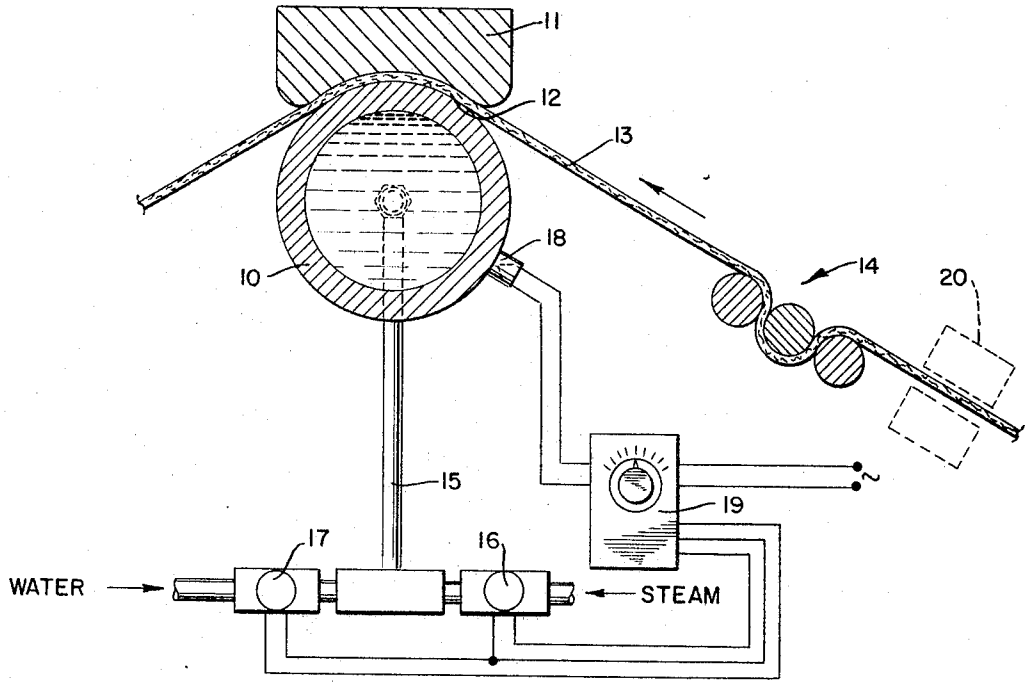
Aug. 9, 1966 F. CATALLO 3,265,270

FABRIC FEEDING SYSTEM

Filed March 4, 1964



INVENTOR.
FRANK CATALLO

BY

Mandeville & Schweitzer
ATTORNEYS

United States Patent Office 3,265,270 Patented August 9, 1966

3,265,270

FABRIC FEEDING SYSTEM

Frank Catallo, Elmont, N.Y., assignor to Samcoe Holding Corporation, Woodside, N.Y., a corportion of New York

Filed Mar. 4, 1964, Ser. No. 349,300
7 Claims. (Cl. 226—175)

The present invention relates to the handling of fabrics, and is directed more specifically to the provision of a novel and improved method and means for feeding fabrics by means of a controllably effective, non-positive feeding surface.

In a typical system for feeding fabrics a feeding surface (typically a roller surface) is arranged to have effectively positive feeding contact with the fabric, and control over the feeding of the fabric is maintained by regulation of the speed of the feeding surface. The system of the present invention, while accommodating regulation of the fabric speed through control of feeding surface speed, provides an additional, independent means of regulating fabric feeding speed by providing a controlled slip feeding relationship between the fabric and the feeding surface, and accurately regulating the extent of the slippage by controlled variation of the temperature of the feeding surface.

The system of the invention is based upon the phenomenon that the frictional characteristics between a fabric and a feeding surface vary with temperature. Accordingly, after initially establishing a predetermined slippage between a fabric and its feeding surface it becomes possible to regulate the extent of the slippage above and below the predetermined "norm" by regulation of the temperature of the feeding surface. Increasing the surface temperature reduces friction and therefore increases slippage. While the theoretical basis for this behavior has not been adequately confirmed, it is possible that the variation of friction characteristics is a function of moisture present at the feeding surface. Thus, with increasing operating temperatures, increasing slippage is observed, and this may result from the driving off or activating of increasing amounts of the residual moisture of the fabric.

In accordance with the invention, fabric is directed over a feeding surface, typically a roller, and is confined against the feeding surface by a second surface, referred to herein as a confining surface, which may be in the form of a roller or other moving surface or may simply be a stationary surface so arranged with the feeding surface as to define a predetermined guide passage for the fabric. The surface characteristics of the feeding surface are such, in relation to the fabrics to be accommodated, the nature of the guiding passage for the fabric, the resistance against which the fabric must be advanced, and other applicable conditions, that the feeding surface and the fabric are in non-positive driving relationship. In other words, under normal operating conditions, there will be at least some slippage between the feeding surface and the fabric.

The effective temperature of the feeding surface is controlled by sensing the surface temperature in an area contacted by the fabric and supplying heating or cooling medium to the feeding surface to maintain it at a predetermined temperature, set by an appropriate regulator. When handling dry fabric at room temperature the feeding surface will be supplied with heating medium. In many operations, however, the fabric will be acted upon in advance of the feeding station by steam, so that it is both hot and moist when it reaches the feeding surface, and in such cases it may be necessary to supply cooling medium to the feeding surface in order to maintain it at the desired predetermined temperature.

For a better understanding of the invention, reference

should be made to the following detailed description and to the accompanying drawing, the sole figure of which is a simplified, schematic representation of a controlled slip fabric feeding system according to the invention.

Referring now to the drawing, the reference numeral 10 designates a hollow feeding roller, which is supported for rotation and driven by suitable means, not specifically shown. In this respect, although the invention is directed to the speed regulation of fabric feeding through controlled slippage, it is also contemplated that the feeding roller 10 be driven at variable speeds to establish a nominal speed level from which the fabric speed may be varied upward or downward by temperature regulation.

In the illustrated system, a guiding shoe 11 is mounted opposite the feeding roller 10 and has a confining surface arranged to form a predetermined passage 12 for a fabric web 13. The surface of the feeding roller may be mildly etched or otherwise conditioned to be able to have limited frictional gripping with the fabric, which may be a cotton knit for example. However, the surface of the roller 10 and the thickness of the passage 12 are such, in relation to the nature and thickness of the fabric 13, that the feeding roller will have non-positive or slipping engagement with the fabric when the fabric is restrained by a predetermined resistance. In the illustrated system, the fabric is restrained by a series of tension bars 14, which are located on the incoming or entry side of the feeding roller 10. However, the feeding system may instead include an exit-side resistance against which the feeding roller will advance the fabric in non-positive relation.

In accordance with a significant aspect of the invention, the feeding roller 10 is controllably supplied with heating and cooling media, for maintaining the feeding surface at a desired, predetermined temperature. Typically, the roller 10 is of hollow construction, and the heating and cooling media are steam and water, respectively, arranged to be introduced through a supply pipe 15, under the control of separate steam and water valves 16, 17.

For sensing the temperature of the feeding roller, it is advantageous to mount a suitable thermocouple element 18 in contact with the roller surface, in an area to be contacted by the fabric and relatively close to the line of tangency between the fabric and feeding roller. The arrangement is such that the condition sensed by the thermocouple is accurately reflective of the feeding surface conditions to which the incoming fabric will be exposed.

In conjunction with the thermocouple element 18 there is provided an adjustable electrical regulator system 19, whose details are not pertinent to the invention but which may be of conventional design using commercially available components. Essentially, the adjustable regulator 19 may be set to correspond to a predetermined temperature level and to provide an output signal according to the relationship between the adjusted setting of the regulator and the electrical signal fed into the regulator by the thermocouple 18. Thus, in the highly simplified system illustrated, either heating or cooling medium may be admitted to the feeding roller 10 by utilizing the regulator output signal to operate the valves 16, 17, which may be solenoid actuated.

Typically, one or the other of the steam or water media will be admitted to the roller 10, but appropriate proportioning and mixing of the media, in order to maintain a steady state of temperature balance, is within the purview of the invention. In a typical installation of an apparatus in accordance with the invention, accommodation may be made for feeding roller surface temperatures ranging from about 200° F. to about 350° F., although that range is not known to be critical.

In many installations, it may be necessary or desirable for other reasons to condition the incoming fabric with

steam, in which case the apparatus may include suitable steam boxes **20** mounted adjacent one or both sides of the fabric. When steam is imparted to the fabric, substantial heat is introduced into the fabric and from the fabric it is transferred into the feeding roller. Because of this, and perhaps also because of the active moisture introduced by steaming, it is usually necessary to cool, rather than heat, the feeding roller in order to maintain it at a predermined temperature within the desired range.

The system of the invention enables a fabric to be fed under conditions of precisely controlled slippage, permitting sensitive feeding adjustments to be made without resorting to delicate physical adjustments of the equipment, which may be very difficult where wide fabric webs must be accommodated, and without making surface speed adjustments, which may be inadequate under certain circumstances. Moreover, the precisely controlled slippage provided for would enable a controlled amount of polish to be imparted to the fabric, if desired.

It should be understood that the specific form of the invention herein illustrated is intended to be representative only, as certain changes may be made therein without departing from the clear teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. A fabric feeding system with controlled slippage comprising

(a) a driven feeding roller engaging one side of a fabric;

(b) a stationary fabric confining surface facing said feeding roller over a substantial portion of its surface area and adapted to engage the other side of the fabric;

(c) fabric travel resisting means positioned on one side of said roller and engaging fabric being advanced by said roller;

(d) said feeding roller, said confining surface, said fabric, and said resisting means being so spaced and related as to effect continuous controlled slippage of the feeding roller surface with respect to said fabric;

(e) means for supplying heating and cooling media to said roller,

(f) means for sensing the temperature of the surface of the feeding roller in an operative surface region thereof engaged by the fabric during rotations of said feeding roller, and

(g) adjustable temperature regulator means associated with said temperature sensing means and said media supply means for supplying heating or cooling means to said feeding roller in accordance with whether the sensed surface temperature of said feeding roller is below or above the adjusted setting of said regulator; whereby

(h) said feeding roller is maintained in controllably slipping relation with said fabric;

(i) the extent of slippage increasing and decreasing directly as a function of increases and decreases, respectively, in roller surface temperature.

2. The apparatus of claim **1**, in which

(a) said feeding roller is of hollow construction;

(b) said means to supply heating and cooling media comprises means for introducing fluid media into the hollow interior of said feeding roller; and

(c) said heating medium and said cooling medium being steam and water, respectively.

3. The method of controllably feeding fabric under resistance with controlled slippage, which comprises

(a) directing the fabric between two surfaces which engage the opposite sides of the fabric, at least one of which is moving;

(b) maintaining said moving surface continuously in a controlled slipping relationship with said fabric;

(c) sensing the surface temperature of the moving surface in an operative region having contact with the fabric during feeding; and

(d) controlling the temperature of said moving surface to maintain the sensed surface temperature at a controllably predetermined level; whereby

(e) said moving surface is maintained in controllably slipping relation with said fabric;

(f) the extent of slippage increasing and decreasing directly as a function of increases and decreases, respectively, in the temperature of said moving surface.

4. The method of claim **3**, in which

(a) said fabric is heated in advance of passage between said surfaces;

(b) a heat exchange medium is controllably supplied to said moving surface; and

(c) said heat exchange medium alternatively is heating or cooling medium.

5. The method of claim **3**, in which

(a) the temperature of said moving surface is controllably maintained at a predetermined, adjusted temperature not substantially outside the range of from 200° F. to 350° F.

6. The method of controllably feeding a fabric, which comprises

(a) directing the fabric over a driven feeding roller and maintaining the fabric in a predetermined pressure relationship with said roller;

(b) applying to the fabric, on one side of the feeding roller, sufficient resistance to feeding movement to impart a continuous and controlled slippage between said fabric and said feeding roller; and

(c) controllably varying the temperature in the area of contact between the fabric and the feeding roller, whereby to increase and decrease the amount of slippage between said fabric and said feeding roller;

(d) the amount of slippage increasing and decreasing directly as a function of increases and decreases of said temperature.

7. The method of controllably feeding a moisture-bearing web material, which comprises

(a) directing the web material over a driven feeding roller and maintaining the fabric in a predetermined pressure relationship with said roller;

(b) applying to the web material, on one side of the feeding roller, sufficient resistance to feeding movement to impart a continuous and controlled slippage between said web material and said feeding roller; and

(c) controllably varying the temperature in the area of contact between the web material and the feeding roller, whereby to increase and decrease the amount of slippage between said web material and said feeding roller;

(d) the amount of slippage increasing and decreasing directly as a function of increases and decreases of said temperature.

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M. HENSON WOOD, JR., *Primary Examiner.*

J. N. ERLICH, *Assistant Examiner.*