June 19, 1951 W. DREISEL 2,557,417

APPARATUS FOR FORWARDING WEB MATERIAL

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Fig. 1.

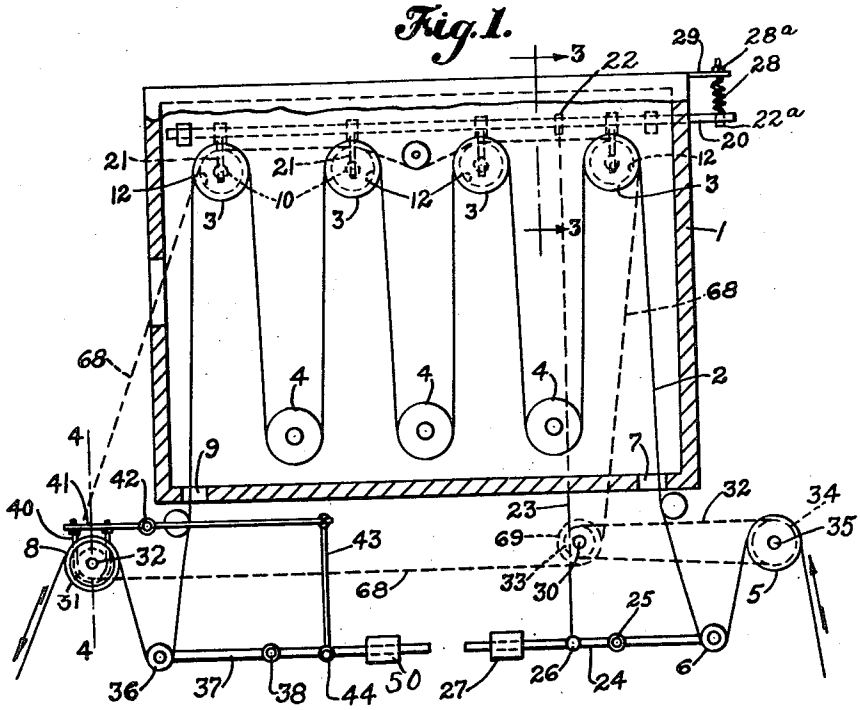
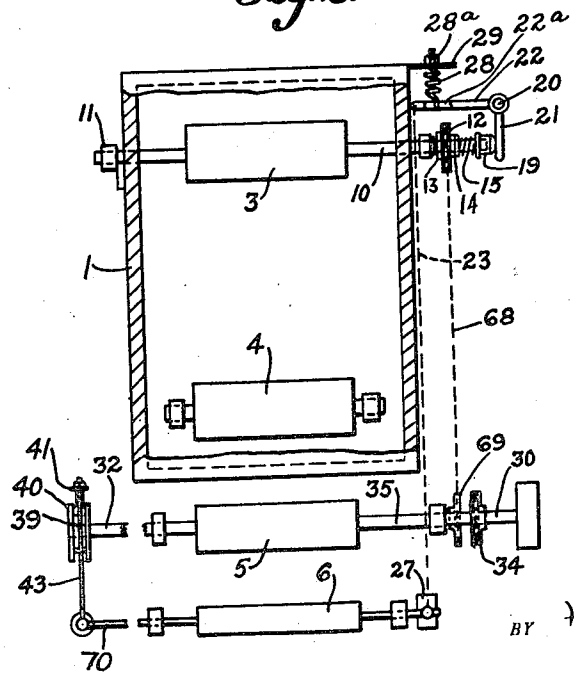


Fig. 2.



INVENTOR.
William Dreisel

BY Heard Smith & Kennett
ATTORNEYS

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Fig. 3.

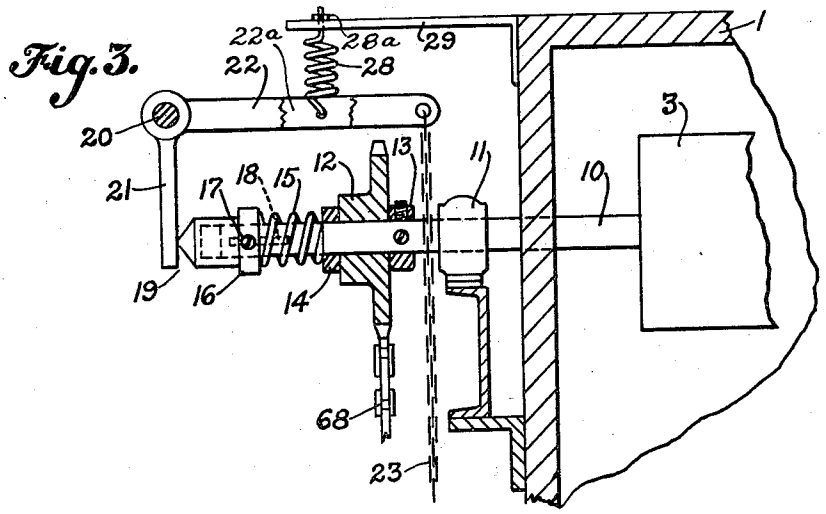


Fig. 4.

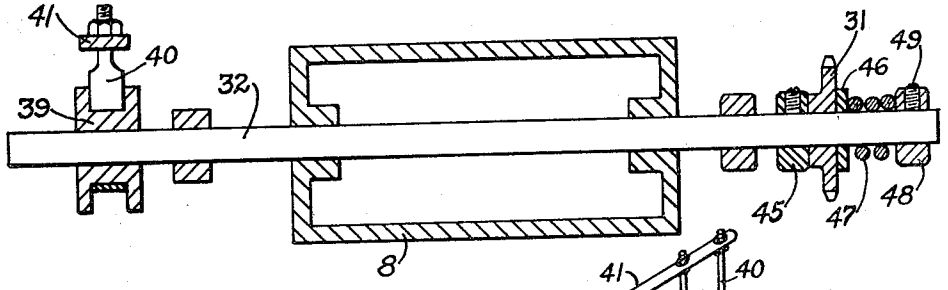


Fig. 5.

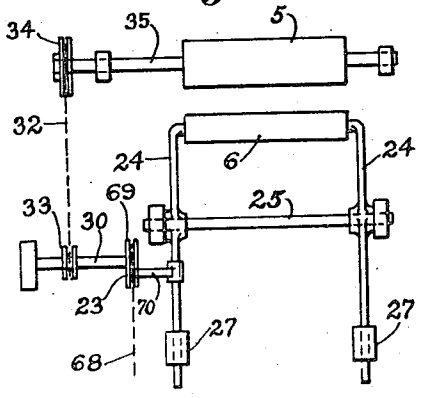
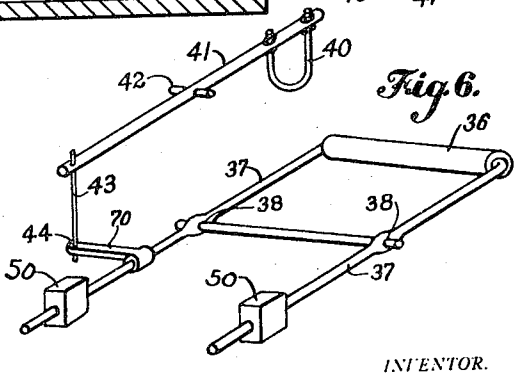


Fig. 6.



INVENTOR.

William Dreisel

BY Heard Smith & Kennard

ATTORNEYS

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2,557,417

APPARATUS FOR FORWARDING WEB MATERIAL

William Dreisel, Lawrence, Mass., assignor to Andrews & Goodrich, Inc., Dorchester, Mass., a corporation of Massachusetts

Application December 2, 1947, Serial No. 789,178

1 Claim. (Cl. 271—2.3)

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This invention relates to apparatus for forwarding web material through a chamber or space in which it is subjected to some processing operation that is likely to cause a change in the overall length of the web.

The drying of cloth in a drying chamber is an example of such a processing operation, inasmuch as during the drying operation the cloth may shrink somewhat, with the result that the lineal measurement of the web of cloth that is fed to the drying chamber is somewhat greater than that of the dried cloth as it is delivered from the drying chamber.

One common way of handling cloth in a drying chamber is to support the cloth to be dried on supporting rolls which are driven for the purpose of forwarding the cloth through the drying chamber, it being understood that the cloth to be dried may be fed to the drying chamber by any suitable cloth-feeding means, some examples of which include a cloth-feeding roll or a machine or apparatus that has performed some previous operation on the cloth and which is situated to deliver the cloth directly to the drying chamber.

It is also common practice to provide some suitable delivery means such as a delivery roll for delivering the dried cloth from the drying chamber. One object of the invention is to provide novel means which is responsive to any change in the length of the web during the drying or other processing operation, a change such as would be produced by a shrinkage of the web, for maintaining such a relation between the speed at which the web material is fed to the apparatus and the speed of both the supporting rolls and the delivery rolls that the tension on the web will not vary appreciably as it travels through the apparatus from the feeding-in means to the delivery roll, notwithstanding any change in its length which may occur due to shrinkage during the drying or processing operation.

In order to give an understanding of my invention, I have illustrated it herein as it might be used in connection with a cloth-drying apparatus of the type above referred to. I wish to state, however, that the invention is not limited in its use to cloth-drying apparatus, but is capable of use in connection with a wide variety of devices adapted to forward web material of different kinds.

Fig. 1 is a view, partly in section, showing a cloth-drying apparatus embodying my invention.

Fig. 2 is an end view of Fig. 1 looking toward the left, parts being shown in section.

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Fig. 3 is an enlarged section on the line 3—3, Fig. 1, with the sprocket wheel shown in section.

Fig. 4 is an enlarged sectional view showing the delivery roll.

Fig. 5 is a fragmentary view illustrating the feed roll and the accompanying dancer roll.

Fig. 6 is a fragmentary perspective view showing the means for applying a retarding action to the delivery roll.

In the drawings 1 indicates a drying chamber, and 2 indicates a length of web material which is to be dried in the drying chamber. For convenience, I will refer to the web 2 as cloth, but I desire to state that the invention is applicable to the forwarding of other forms of web material than cloth.

Within the drying chamber 1 are a plurality of upper supporting rolls 3 over which the cloth passes and by which it is supported, and there is also shown a series of lower guide rolls 4 under which the cloth passes as it travels from one supporting roll to the other. The cloth 2 is therefore festooned over the supporting rolls 3, this being a common arrangement in drying apparatus.

The means for feeding the cloth to be dried to the drying chamber is herein shown as a positively driven feed roll 5, but as stated above, the cloth-feeding means may be some machine which performs some prior operation on the cloth and which delivers the cloth directly to the drying chamber.

The drying chamber 1 is shown as provided with an opening 7 in its bottom, through which the web 2 is fed into the chamber.

The cloth is delivered from the drying chamber by a delivery roll 8, said cloth passing out of the chamber through an opening 9 and thence to the delivery roll.

Means are herein provided for driving both the supporting rolls 3 and the delivery roll 8 at speeds which have such a relation to the speed at which the cloth is fed to the apparatus by the feed roll 5 that the tension on the cloth will not vary appreciably between said roll 5 and the delivery roll 8 notwithstanding any change in the length of the cloth which may result from shrinkage thereof.

Each supporting roll 3 is carried by a shaft 10 which is mounted in suitable bearings 11, and each shaft 10 is driven through a friction drive device, hereinafter described, that is controlled by the movements of a dancer roll 6 which rests on the length of cloth between said feed roll 5 and the drying chamber and which serves to apply a slight tension to the cloth. Said dancer roll is shown as mounted on a lever element 24

pivotally mounted at 25 and preferably provided with a counterweight 27 that is adjustably mounted thereon. The tension which the dancer roll 6 applies to the cloth 2 may be varied by shifting the position of the counterweight, said tension being increased as the counterweight is shifted toward the pivotal axis 25 and being reduced as said counterweight is shifted away from said axis.

Each shaft 10 has loosely mounted thereon a sprocket wheel 12 which is confined between a collar 13 that is fast on the shaft 10, and a spring-pressed collar 14. The sprocket wheels 12 are driven at a uniform speed and the torque which each sprocket wheel transmits to its shaft 10 results from the frictional engagement between said sprocket wheel and the collars 14 and 13.

The collar 14, which is loose on each shaft 10, is secured to one end of a spring 15 that encircles the shaft, the other end of said spring being secured to a collar 16 which is mounted on the shaft 10 so that it can move longitudinally thereof, but is connected thereto for rotation therewith. As herein shown, the collar 16 carries a screw 17, the inner end of which operates in a groove 18 with which the shaft 10 is provided.

The collar 16 has rigid therewith a cap member 19 which encloses the end of the shaft 10.

Means are provided whereby the tension on the various springs 15 varies with the up and down movement of the dancer roll 6, and for this purpose there is provided a shaft 20 which extends longitudinally of the drying chamber and which is provided with a plurality of arms 21, one for each of the cap members 19. These arms 21 are fixed to the shaft 20 by means of a set screw or other suitable means so that each arm may be adjusted angularly about said shaft, and each arm bears against the outer end of a cap member 19.

The shaft 20 has another arm 22 rigid therewith which is connected by a flexible connection 23 to the lever element 24 that carries at its end the dancer roll 6. The connecting point 26 between the connection 23 and the lever 24 is on the opposite side of the pivotal point 25 of the lever from the dancer roll.

The counterweight 27 tends to swing the lever 24 in a counter-clockwise direction (see Fig. 1) thereby tending to pull the arm 22 downwardly, and this tendency is opposed by a pulling spring 28 which is adjustably connected at its upper end to a bracket 29 mounted on the casing 1 and is connected at its lower end to an arm 22a similar to the arm 22 that is rigid with the shaft 20.

The counterweight 27 is so adjusted that the weight of the dancer roll combined with the action of the spring 28 will apply a desired tension on the cloth between the cloth-feeding means and the supporting rolls, and the arms 21 are so individually adjusted on the shaft 20 that when the desired tension on the cloth has been established, each arm 21 will apply a sufficient pushing force against its cap 19 to provide the necessary friction engagement between the corresponding sprocket wheel 12 and the collars 13 and 14 to drive the corresponding shaft 10 and supporting roll 3 at the proper speed to maintain a substantially uniform tension on the cloth notwithstanding any shrinkage that may occur in the cloth during its passage through the chamber 1.

If, in the operation of the machine, the cloth is being fed into the drying chamber faster than it is being forwarded by the rolls 3, the length of the cloth between the feed roll and the drying chamber will increase, and the dancer roll 6 will consequently move downwardly. Such downward movement swings the lever 24 clockwise, thereby relieving the downward pull on the connection 23, with the result that the spring 28 acts automatically to raise the lever 22 and to move the arms 21 toward the right, Fig. 3, thereby increasing the pressure of the springs 15 against the collars 14 and increasing the frictional engagement between each sprocket wheel 12 and its collars 14 and 13.

It will be understood that the sprocket wheels 12 are being driven at a speed somewhat greater than the normal speed of the supporting rolls 3, so that, normally a certain amount of slippage occurs between each sprocket wheel and its collars 13, 14.

When the dancer roll 6 moves downwardly, and the spring pressure on the collars 14 is increased, such slippage will be reduced and the speed of the supporting rolls 3 will be increased, whereby the cloth will be forwarded through the drying chamber at an increased speed.

On the other hand, if during the operation of the machine, the supporting rolls 3 are feeding the cloth forwardly faster than it is delivered by the feed roll 5, the slack in the cloth between the supporting rolls and the feed rolls will be reduced and the dancer roll 6 will be moved upwardly.

Such upward movement will, through the lever 24, cause a downward pull on the connection 23, thereby moving the lever 22 downwardly and reducing the pressure of the springs 15 against the collars 14, thereby reducing the frictional engagement between the sprocket wheels and the collars 13 and 14, with the result that the speed of the supporting rolls 3 will be reduced.

I have, therefore, provided means, which is responsive to any change in the length of the cloth between the cloth-feeding means 5 and the supporting rolls 3, to vary the rotative speed of the supporting rolls so as to maintain a proper speed relation between the supporting rolls and the cloth-feeding means by which each feed roll will take the cloth and feed it forward at such a speed that the cloth will be maintained under a substantially uniform tension from the point at which it is delivered from the feed roll 5 to the last supporting roll 3.

The sprocket wheels 12 for the various supporting rolls may be driven in any suitable way and, as stated above, said sprocket wheels are rotated at a speed somewhat faster than the speed at which the rolls 3 are rotated by the cloth as it travels through the drying chamber, so that normally a certain amount of slippage occurs between each sprocket wheel and the corresponding collars 13 and 14. As herein shown, the sprocket wheels 12 are all driven by a sprocket chain 68 which passes around and is driven by a sprocket 69 on a drive shaft 30, the sprocket chain also passing around and driving a sprocket wheel 31 loosely mounted on the shaft 32 of the delivery roll 8. The drive shaft 30 may be driven from any suitable source of power. In the illustrated embodiment of the invention, the feed roll 5 is positively driven from the drive shaft 30 through the medium of a sprocket chain 32 which passes around a sprocket wheel 33, fast on the shaft 30 and around another sprocket

wheel 34 fast on the shaft 35 carrying the feed roll 5. If any shrinkage takes place in the cloth during its travel through the drying chamber, the speed at which the cloth is delivered from the drying chamber will be less than that at which it is fed into the chamber by an amount proportionate to the amount of the shrinkage. Since each supporting roll 3 is driven by the non-positive friction drive, it will readily adapt itself to the speed at which the cloth is moving thereover so that no appreciable change in the tension of the cloth will occur between the first and the last suppporting roll due to shrinkage of the cloth.

My invention also provides means for automatically controlling the speed of rotation of the delivery roll 8 to correspond to the speed at which the cloth is delivered from the supporting rolls 3, and at the same time maintaining the correct tension on the cloth that has been predetermined by the setting of the counterweight 27. For this purpose the shaft 32 of the delivery roll 8 is driven from the sprocket wheel 31 by a friction drive device, and means are provided for applying a braking or retarding action on the shaft 32 which varies in accordance with variations in the length of the cloth between the supporting rolls and the delivery roll.

As the cloth 2 is delivered from the drying chamber, it passes underneath a dancer roll 36 which is carried at one end of a lever 37 pivotally mounted at 38. The lever 37 is provided with a counterweight 50 which may be adjusted so that the dancer roll 36 will apply substantially the same tension on the cloth as the dancer roll 6. The shaft 32 of the delivery roll has mounted thereon a brake drum 39 with which cooperates a brake band 40 that partially encircles the drum. This brake band is secured to one end of a lever 41 that is pivoted at 42, the other end of the lever being connected by a link 43 to an arm 70 which is rigid with the lever 37 and extends laterally therefrom as shown at 44, the connection 44 being on the opposite side of the pivotal point 38 from the dancer roll 36.

The friction drive between the sprocket 31 and the shaft 32 is similar to that between the sprocket 12 and shaft 10.

The sprocket 31, which is driven by the sprocket chain 68, is loose on the shaft 32 and is confined between two collars 45, 46. The collar 45 is fast to the shaft 32 and the collar 46 is rigid with one end of a spring 47 that encircles the shaft, the other end of the spring being connected to a collar 48 that is adjustably mounted on the shaft 32 and is held in adjusted position by a set screw 49. The sprocket wheel 31 is normally rotated at a speed somewhat faster than that of the delivery roll 8 so that a certain amount of slippage will occur between the sprocket 31 and the collars 45 and 46 during the operation of the machine.

If, at any time, the cloth is being delivered from the supporting rolls 3 faster than it is fed forward by the delivery roll 8, the slack between the last supporting roll 3 and the delivery roll 8 will increase with the result that the dancer roll 36 will move downwardly. This will turn the lever 37 counterclockwise and will operate through the link 43 and lever 41 to relieve somewhat the retarding pressure of the brake band 40 on the brake drum, with the result that the speed of the delivery roll will increase.

If the delivery roll is feeding the cloth forward faster than it comes from the supporting rolls, then the slack or loop in which the dancer roll 36 is located will decrease, thereby raising said roll and turning the lever 37 clockwise. This will operate through the lever 41 to increase the braking or retarding action of the brake band 40 on the brake drum 39, thereby slowing down the speed of the delivery roll 8.

In this invention, therefore, the speed of rotation of the delivery roll 8 is maintained in a proper relation to the speed at which the cloth is fed forward by the supporting rolls, so that the portion of the cloth between the supporting rolls and the delivery rolls will be maintained under a substantially uniform tension, and the cloth will be fed forward by the delivery roll at the same speed at which it is delivered from the supporting rolls, regardless of the amount of shrinkage which the cloth may experience during the drying operation. This invention, therefore, provides means by which a substantially uniform tension will be maintained on the cloth from the time it is delivered from the feed roll 5 to the time it is delivered from the delivery roll 8 notwithstanding any change in the length of the cloth caused by shrinkage thereof.

As has been stated above, the invention is not limited in its use to the forwarding of cloth through a drying chamber, but is capable of use with a wide variety of devices that are constructed to forward web material through a chamber or space in which such web material is subjected to a processing operation that may result in a change in the over-all length of the web.

I claim:

An apparatus for feeding a web of cloth through a cloth-processing chamber comprising cloth-feeding means to feed a web of cloth to be processed to said chamber at a predetermined uniform speed, a plurality of cloth-forwarding rolls in said chamber by which the cloth is supported in festoon formation and is fed forward, an individually adjustable non-positive driving device for each roll, spring-actuated means common to all said driving devices and normally tending to increase the torque which each driving device transmits to its roll, a vertically movable dancer roll resting on the section of the cloth between the cloth-feeding means and the first cloth-forwarding roll and movable vertically in response to variations in the length of said section of cloth, connections between said dancer roll and said spring-actuated means by which a downward movement of said dancer roll resulting from an increase in the length of said section of cloth will increase the effective action of said spring-actuated means and thus increase the torque of all the driving devices and an upward movement of said dancer roll resulting from a decrease in the length of said section of cloth will decrease the effective action of said spring-actuated means and thus decrease the torque of the driving devices, whereby the entire length of cloth between the cloth-feeding means and the last cloth-forwarding roll will be maintained under a substantially uniform tension notwithstanding any shrinkage which may occur in said cloth during the processing operation, a delivery roll by which the processed cloth is delivered from the chamber, a non-positive driving means for rotating said delivery roll, and means responsive to variations in the length of the section of cloth between the last cloth-forwarding

roll and the delivery roll to vary the torque of the driving means for the delivery roll, whereby the cloth will be fed by the delivery roll at the same speed as it is delivered from the last cloth-forwarding roll and said last named section of cloth will be maintained under the same tension as the length of cloth between the cloth-feeding means and the last cloth-forwarding roll.

WILLIAM DREISEL.

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