

Nov. 8, 1938.

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2,135,516

ROLL TYPE DRIER

Filed March 22, 1937

Fig. 1.

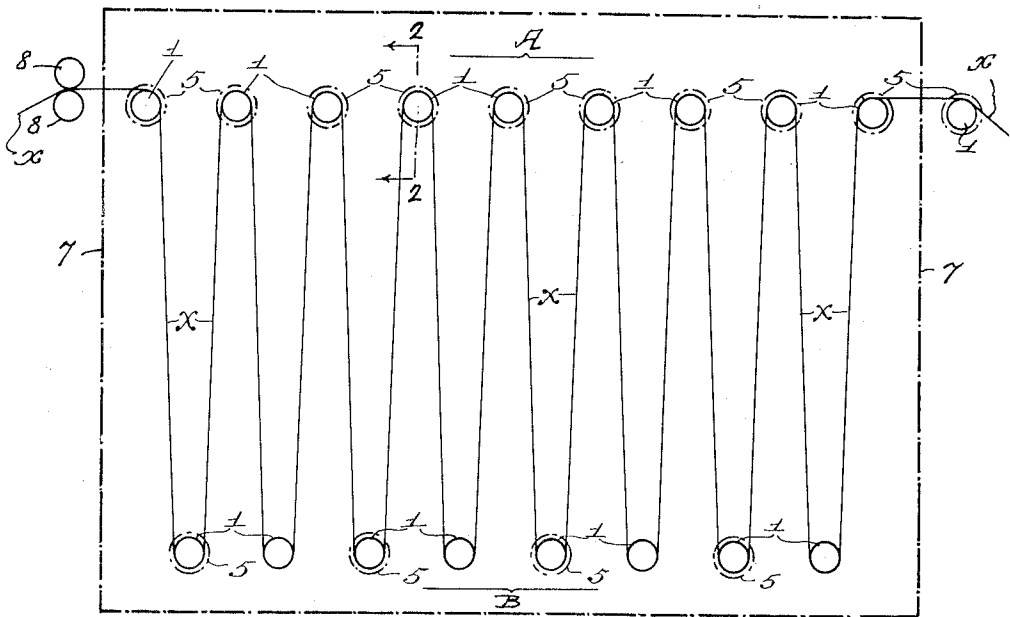
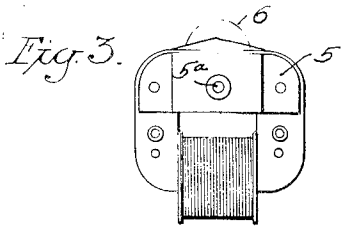
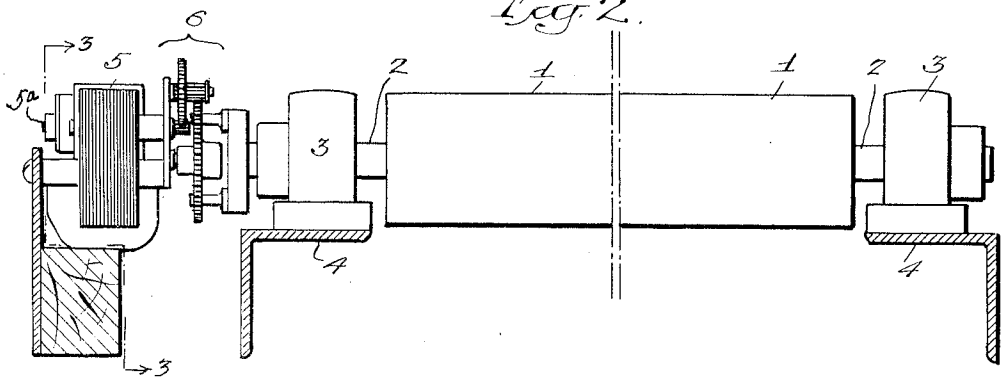


Fig. 2.



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2,135,516

ROLL TYPE DRIER

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Application March 22, 1937, Serial No. 132,425

5 Claims. (Cl. 271—2.3)

This invention relates to mechanisms for handling continuous web materials, wherein the material is threaded back and forth, vertically or horizontally, between and around two relatively spaced sets or series of rolls and advanced thereby in one general direction, as in cloth or paper driers or other conditioning or treating chambers, etc.

Normally the trunnions of the rolls are rotatably mounted in fixed bearings which maintain the two series of rolls in definite spaced relation to each other. Under these circumstances, shrinkage of the web longitudinally, beginning simultaneously with the starting of the drying of the material and increasing as the drying progresses, places the web under a constantly increasing tension. Such tension, in many instances, results in damage to either the web or the mechanism or both.

The above noted condition is further aggravated by the rolls of one or both series being positively driven constantly from a common source of mechanical power, all at the same constant uniform speed, which causes the shrinkage and its resultant tension, occurring between successive rolls, to accumulate or build up progressively, and to reach a maximum between the rolls around which the web in its more thoroughly dried state passes.

Efforts have been made to overcome the above noted difficulty, by dividing the rolls into groups; and by placing a floating free running roll between successive groups, to rise and fall as the tension of the web varies; and by using the rise and fall of the floating roll to control a speed-changing mechanism for driving the next succeeding group of rolls at a different speed from that of the preceding group of rolls.

The above noted practice, while it relieves the undesirable condition to some extent it does not completely overcome the trouble, as the same undesirable condition obtains, although to a somewhat lesser degree, in each group of rolls.

The object of the present invention is to eliminate the above noted undesirable condition, by providing a separate individual driving motor for each roll, or for each alternate roll, or for each roll of any predetermined number thereof, as will be fully disclosed hereinafter, reference being had to the accompanying drawing, of which:

Fig. 1 diagrammatically illustrates a drier or other treating device for web materials, including a plurality of independently driven rolls in accordance with the principles of the present invention;

Fig. 2 is a transverse section taken on the line

2—2, Fig. 1, showing the individual driving motor of one of the rolls; and

Fig. 3 is a section taken on the line 3—3, Fig. 2. As shown in Fig. 1, a continuous web x passes alternately around and between successive rolls 1, 1 of two separate relatively spaced series A and B thereof.

Each roll 1 is provided with a shaft or trunnions 2 which extend axially beyond the opposite ends respectively of the roll. Each of the axial projections 2 is rotatably mounted in a bearing 3 secured to a rigid support 4.

Each of any predetermined number of the rolls 1, of each or either of the series A and B, is provided with a separate individual and independent drive of its own, in the form of an electric motor 5.

The rotor shaft 5a of each motor 5 may be connected to the shaft 2 of the particular roll 1 which is driven by the motor 5 in any suitable manner, preferably through speed reduction gearing 6.

The rolls 1, 1 may be encased in any suitable enclosure 7 in which any suitable web-treating medium may be circulated in any well known manner.

The web x may be fed into the enclosure 7, to the rolls 1 therein, at a predetermined definite speed by any suitable means such for example as a pair of grip rolls 8, 8. The feed rolls 8, 8 may be driven at any suitable predetermined speed, variable at the will of the operator, by any suitable means, not shown.

The motors 5 preferably are of a commercially available type known as "single phase shaded-pole motors". These motors are particularly adapted for use in the present instance because of certain characteristics of this type of motor which permits the motor to be stopped, as by overloading, for indefinite periods of time, with current flowing through the motor windings, without the motor becoming overheated or damaged. These same characteristics permit the motor to be restricted to any speed within its full range, from its maximum number of revolutions per minute, when under minimum load, to zero or full stop, under overload, without harm, by variations occurring in the torque load applied to the motor. The characteristics of this type of motor also allow the motor to start under full load from a dead stop.

In the present instance each motor 5, when supplied with a definite amount of electric energy, develops a definite amount of power which is sufficient to drive the roll 1 connected thereto

at a normal definite speed, under a normal definite torque load applied, through the web x and roll 1, to the rotor of the motor 5.

The grip rolls 8, 8 feed the web x at a definite predetermined rate of speed which is less than the maximum peripheral speeds of the advancing rolls 1, 1. Thus the feed rolls 8, 8 apply a definite resistance to the advance of the web x by the rolls 1, 1 and primarily determines the normal torque load on the motor 5. Any additional amount of resistance to the rotation of any of the rolls 1, 1, applied by the web x , will result in proportionate reductions in the speeds of the motors which respectively drive such rolls.

The intensity of the pull on the web by the rolls 1, 1, and the consequential tension of the web remain substantially constant at all speeds of the motors. In other words, the web-advancing effort exerted on the web by each roll remains substantially constant even though the resistance to the rotation of the roll and the peripheral speed of the roll may vary in accordance with variations occurring in the torque load of the roll as applied thereto by the web.

Under the above noted conditions, assuming that a moistened web is threaded around the rolls of the series A and B alternately and fed to the initial roll 1 in the casing 7 at a predetermined speed by the feed rolls 8, 8, and all the motors 5 are supplied with equal energy, all the rolls 1, 1 would rotate at the same peripheral speed and the web x would be advanced at a constant uniform rate of speed, under a constant uniform tension, throughout its passage around and between the rolls 1, 1. The web would be delivered from the last roll at said same rate at which it was fed to the first roll.

If heated air or other drying medium be applied to the web during its passage from the first to the last of the rolls, the web will begin to dry immediately upon, or in a short time after, its entrance into the chamber 7, and the drying will progress as the web continues to be advanced by the rolls 1, 1 successively.

As the drying progressively increases, the web will shrink and the shrinkage will progress and increase with the drying. As the shrinkage increases, the length of the web between the terminal rolls, i. e. first and last roll, will decrease. Thus the web will be delivered from the last roll at a lower rate than it is being fed to the first roll. This has the effect of progressively increasing the resistance to the rotation of the successive rolls 1 and under the conditions of operation of the motors 5, as noted above, the relative speeds of the successive rolls 1, 1 will automatically decrease and maintain a substantially uniform tension on the web constantly, thereby eliminating the undesirable conditions and damages attending the drying of webs under current practices.

The speeds at which the motors would operate under the circumstances just described are not the maximum speeds of the motors, as above noted. Therefore, if for any reason the web would stretch, intentionally or otherwise, the drag or resistance presented to the rotation of the rolls by the web would decrease and permit the motors to increase their speeds. Thus, in cases where a web would stretch progressively, i. e. where the web would be moistened after entering the chamber 7 instead of being dried therein, the rate of discharge of the web from the last roll would be greater than the rate of feed to the first roll, and the intermediate rolls would in-

crease their speeds accordingly to compensate for the variations in the length of the web and thereby maintain the web under substantially uniform tension in its passage through the rolls.

From the above, it will be clear that in using an independent driving motor for each of any desired number of the web-advancing rolls of an apparatus for treating webs, wherein each of the roll-driving motors has the characteristics above noted, it is only necessary to feed the web into the treating chamber at any predetermined speed and the rolls will drive the web through regardless of shrinkage and stretch, so long as the web is not fed in faster than the predetermined maximum speed of the rolls which are driven by the motors respectively.

I claim:

1. In a web-treating apparatus, the combination of a plurality of web-advancing rolls around which the web passes successively, means for feeding the web to said rolls at a predetermined rate of speed, and an independently operable driving motor for each one of a predetermined number of said rolls, the speeds of said motors being controlled collectively by the web and the rate of feeding thereof to said rolls by said feeding means and independently by variations occurring in the amount of resistance presented to the rotations of the respective rolls as applied thereto by the web intermediate the terminal rolls of said plurality.

2. In a web-treating apparatus, the combination of a plurality of web-advancing rolls around which the web passes successively, means for feeding the web to said rolls at a predetermined rate of speed, and an independently operable electric driving motor for each one of a predetermined number of said rolls, the speeds of said electric motors being controlled collectively by the web and the rate of feeding thereof to said rolls by said feeding means and independently by variations occurring in the amount of resistance presented to the rotations of the respective rolls as applied thereto by the web intermediate the terminal rolls of said plurality.

3. In a web-treating apparatus, the combination of a plurality of web-advancing rolls around which the web passes successively, means for feeding the web to said rolls at a predetermined rate of speed, and an independently operable electric driving motor of the single phase shaded-pole type for each one of a predetermined number of said rolls, the speeds of said electric motors being controlled collectively by the web and the rate of feeding thereof to said rolls by said feeding means and independently by variations occurring in the amount of resistance presented to the rotations of the respective rolls as applied thereto by the web intermediate the terminal rolls of said plurality.

4. In a web-treating apparatus, the combination of a plurality of web-advancing rolls around which the web passes successively, means for feeding the web to said rolls at a predetermined rate of speed, and an independently operable electric driving motor of the single phase shaded-pole type for each one of a predetermined number of said rolls, the speeds of said electric motors being controlled collectively by the web and the rate of feeding thereof to said rolls by said feeding means and independently by variations occurring in the amount of resistance presented to the rotations of the respective rolls as applied thereto by the web intermediate the terminal rolls of said plurality, said feeding means and

driving motors cooperating to maintain the web under substantially constant tension between said terminal rolls.

5 5. In a web-treating apparatus, the combination of a plurality of web-advancing rolls, means for feeding a web to said rolls at a predetermined rate of speed, an independently operable driving motor for each one of a predetermined number of said rolls, means operably coupling each driv-
10 ing motor to its associated roll, the speeds of the independently driven rolls being directly governed by the rate of feeding of the web to said rolls and

varying proportionately with variations occurring in the amount of resistance presented to the respective rolls by variations occurring in the length of the web intermediate the terminal rolls of said plurality, said motors through said cou- 5 plings independently maintaining substantially uniform rotational effort to said rolls respectively and a resultant substantially constant tension on said web during said variations in the respective speeds of the rolls. 10

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