United States Patent

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[54] WEB OR STRIP MATERIAL HANDLING APPARATUS

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[58] **Field of Search** 242/75.4, 58.1, 75.44, 55.01, 242/75.3, 75.51; 226/118, 119, 189

[56] **References Cited**

UNITED STATES PATENTS

1,286,331	12/1918	James	242/75.44
3,258,214	6/1966	Comstock	242/75.3 X
3,278,100	10/1966	Hornberger	226/189
3,414,208	12/1968	Butler	242/58.1
3,249,316	5/1966	Loose	242/75.44

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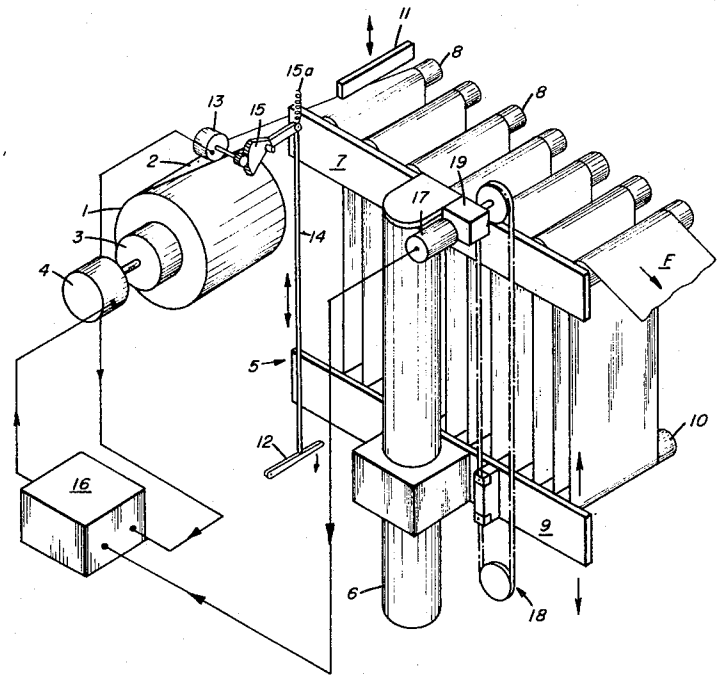
[57] **ABSTRACT**

Web material is processed through a magazine mechanism which stores a quantity of such web material, thereby to permit successive rolls of the web material to be spliced together without stopping the processing. The magazine comprises two relatively movable sections which come together gradually as web material is given up from the magazine during the splicing operation; and gradually part, after splicing is effected, thereby to refill the magazine. Means is disclosed for assuring that the movement of the relatively movable magazine parts do not cause undulation or the like within the web material.

4 Claims, 2 Drawing Figures



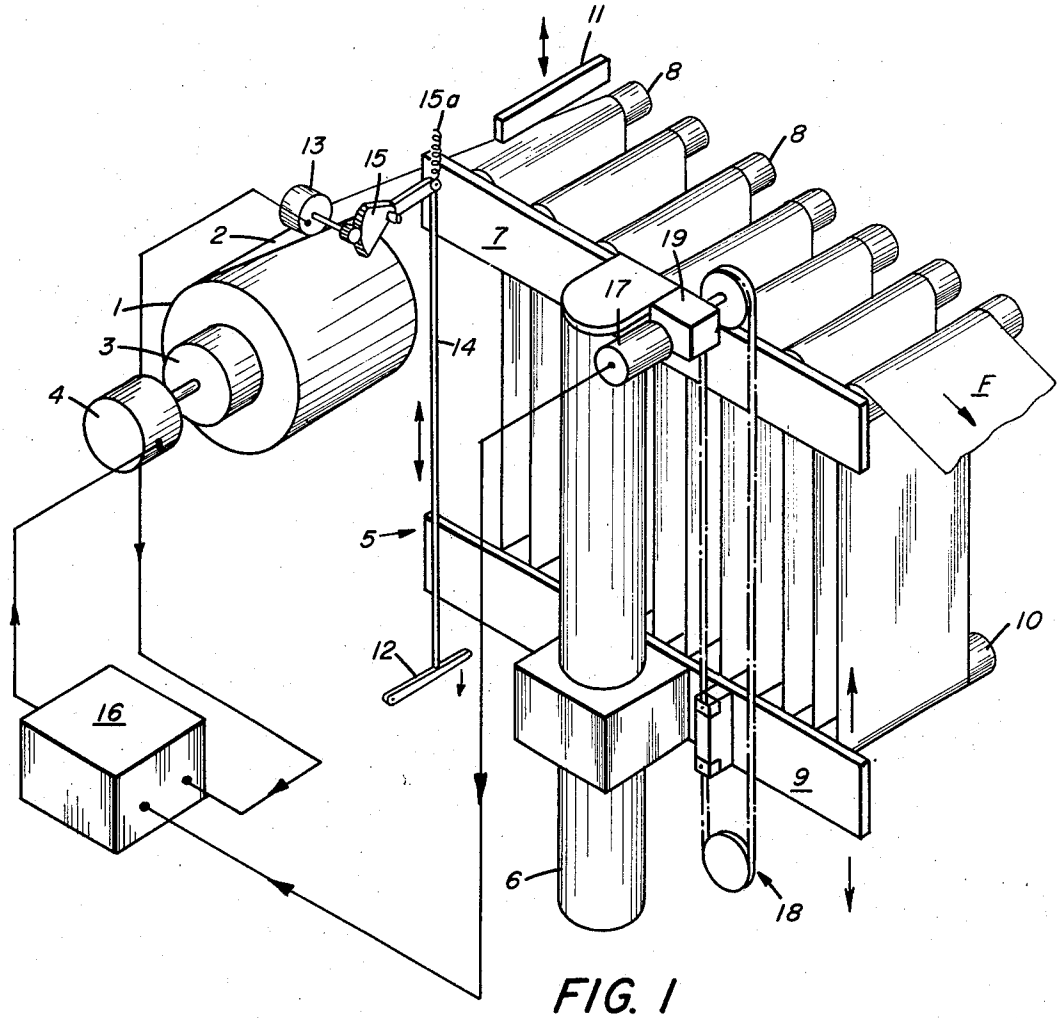


FIG. 1

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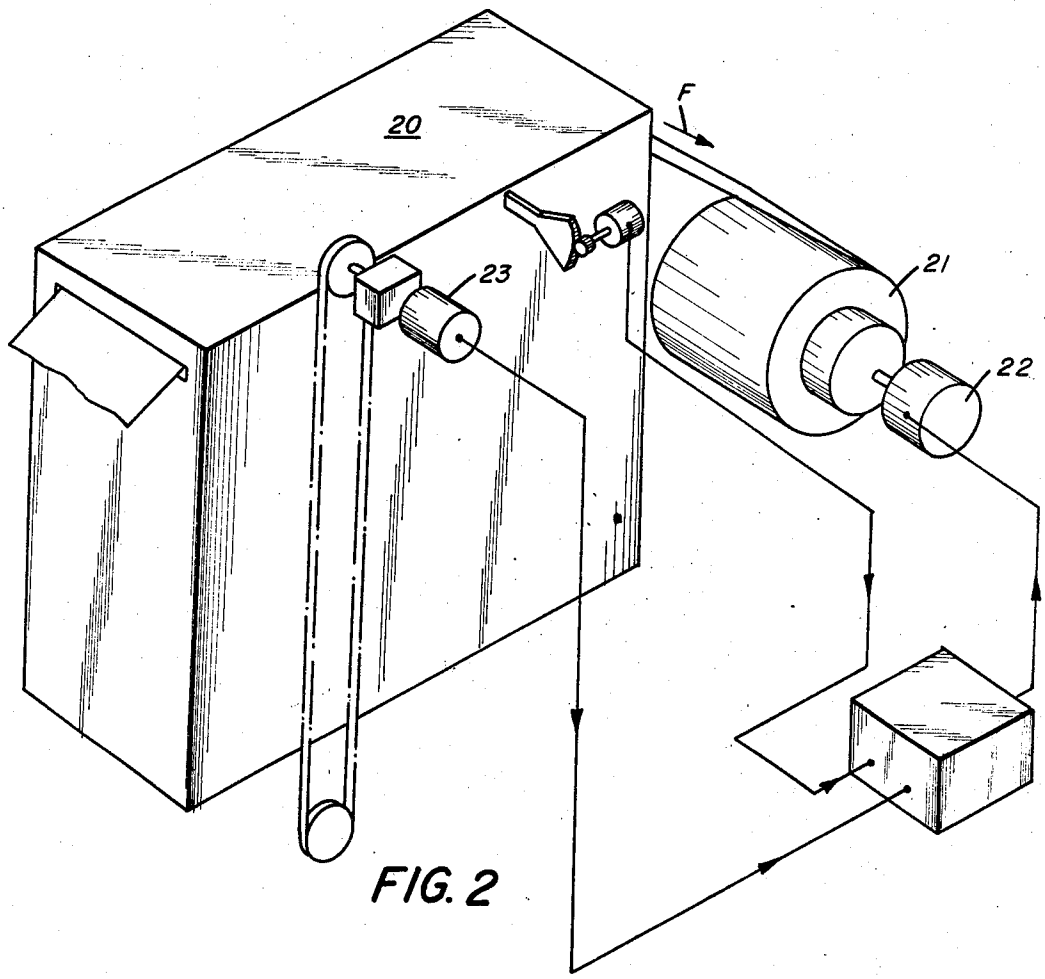

FIG. 2

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WEB OR STRIP MATERIAL HANDLING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to web or strip material handling apparatus and more particularly, but not exclusively, to an apparatus for providing an uninterrupted supply of web or strip material at a substantially constant tension, from a discontinuous source.

2. Description Relative to the Prior Art

As web and strip materials are usually supplied in roll form, an apparatus for supplying web or strip to a process which relies upon a continuous intake of such material must be able to continue supplying the web or strip even during replacement of the supply roll.

An apparatus which has been developed for this purpose comprises a stationary group of horizontally disposed rollers arranged in horizontal alignment with their axes parallel and equidistantly spaced, and a similarly disposed and arranged group of rollers beneath the stationary group and free for vertical movement in parallel relation with respect thereto. The lower movable group of rollers is biased for downward movement, for instance, by its own weight, and the rollers of this group are in staggered relationship with the rollers of the upper stationary group. Together, the two groups of rollers form part of a supply-magazine.

When web or strip material from a supply-roll thereof is alternately threaded around successive rollers of each group so as to follow a serpentine path through the magazine, the length of such path and hence the capacity of the magazine to store material can vary according to the vertical distance between the two groups of rollers. This tends towards a maximum due to the bias applied to the lower movable group of rollers.

Upon depletion of the supply-roll further intake of material into the magazine is for the moment stopped while a fresh supply-roll is substituted and the leading end thereof spliced to the trailing end of the deplete roll. During this time, however, material can continue to be drawn from the store thereof in the magazine by virtue of the lower group of rollers being raised, by the material, towards the upper stationary group of rollers. This causes a shortening of the serpentine path of the web in the magazine. Upon completion of the supply-roll changeover and resumption of intake of web or strip into the magazine, which, of course, has to be accomplished before depletion of the supply of material in the magazine, the lower group of rollers, because of its own weight, moves downwardly away from the upper group of rollers. Hence, the magazine can replenish itself with material in readiness for the next replacement of the supply roll.

In practice, the supply-roll can be braked in order to produce a tension in the web or strip material. If, however, the lower group of rollers descends unevenly during replenishment of the supply-magazine and/or comes to an abrupt halt at the bottom of its travel, unwanted fluctuations in web or strip material tension can occur which might even cause breakage of the web or strip material.

SUMMARY OF THE INVENTION

According to the present invention, there is provided web or strip material handling apparatus comprising rotatable means for supporting a roll of the material, guide means arranged to guide the material to or from the roll and to provide a guide path for the material variable in length between a maximum and a minimum for maintaining a correspondingly variable store of the material therein, an electrical mechanism directly responsive to the rate of variation of the length of the guide path, and means responsive to electric signals from the electrical mechanism for controlling rotation of the rotatable means.

An object of the present invention is the provision of an apparatus for providing a continuous supply of web or strip material at substantially even tension.

By way of example, the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 illustrates schematically a preferred embodiment of a web or strip material handling apparatus according to the invention; and

FIG. 2 illustrates an alternative arrangement of the apparatus shown in FIG. 1.

Referring to FIG. 1 of the drawings, and to the position of the apparatus shown therein, a supply-roll 1 of web material 2 is mounted on a free running shaft 3 to which a braking force can be applied by means of a magnetic particle clutch 4. The clutch 4 comprises a stator and a rotor mounted for rotation with the shaft 3. The web 2 passes from the supply-roll 1 thereof over a splicing table (not shown) and past a web sensing device (also not shown) and through a rechargeable supply-magazine denoted generally by the number 5 and thence to a subsequent web-treatment-process (not shown), by the action of a drawing force F in the direction of the web-treatment process.

The supply magazine comprises a vertical kingpost 6 at the top of which is supported in fixed horizontal relation thereto a beam 7 carrying an array of horizontally disposed top rollers 8 arranged in horizontal alignment with their axes parallel and equidistantly spaced. A beam 9 carrying a similarly disposed array of bottom rollers 10 is mounted on the kingpost 6 beneath the beam 7 and in parallel relation with respect thereto, the bottom rollers 10 being in staggered relationship with the top rollers 8. The beam 9 is free to slide vertically up and down on the kingpost 6 in parallel relation with respect to the beam 7; however, the weight of the beam 9 and the rollers 10 supported thereon tends to keep the distance between the top rollers 8 and the bottom rollers 10 at a maximum.

With web threaded alternately around successive top and bottom rollers as shown, that is, so as to follow a serpentine path through the magazine, the quantity of web stored in the magazine as determined by the length of the serpentine path of web in the magazine, will be a maximum due to the gravitational bias of the bottom roller-array as long as web continues to unroll from the supply-roll. A web tension can be obtained by appropriate adjustment of the braking effect exerted by the magnetic clutch on the supply-roll, which, in turn, is governed by the position of the bottom roller array as will be described hereinafter. Upon depletion of the supply roll, the trailing end thereof moves by the web sensing device which actuates a clamp 11 to clamp the end before it enters the magazine. Preferably, however, the clamp can be operated manually when it is noticed that the supply roll is nearing depletion. The clamp 11, for example, can be a pair of braked rollers. While a fresh supply-roll is being substituted for the deplete roll and the leading end thereof is being spliced to the trailing end of the deplete roll, intake of web into the supply-magazine is, for the moment, stopped; however, web can continue to be drawn from the store of web in the magazine at the rate required for feeding into the subsequent web-treatment-process by virtue of the web itself raising the lower roller array and shortening the serpentine path of the web in the magazine. In order to avoid an interruption in web supply, the supply-roll changeover and the resumption of web intake into the magazine by the releasing of the clamp must, of course, be accomplished before the bottom roller-array has risen to meet the top roller array. Upon the resumption of intake of web into the magazine, the bottom roller-array descends, thereby increasing the length of the serpentine path which the web has to follow through the magazine, again to build up a store of web therein in readiness for when the next fresh supply-roll is required.

It will be appreciated that if the velocity of the bottom roller-array throughout its descent is uneven, unwanted fluctuations in web tension will occur. Also, if the bottom roller-array is brought to an abrupt halt at the bottom of its travel this could result in a momentary acute decrease in web tension caused by overrun of the supply-roll 1, followed by a severe jerk which might even cause breakage of the web.

In order to prevent such fluctuations in web tension occurring, the rate of descent of the bottom roller-array is automatically controlled by means of an electrical mechanism which causes the magnetic clutch **4** to apply a braking force to the shaft **3** on which the supply-roll **1** is mounted, throughout the descent of the bottom roller-array.

Referring again to FIG. **1**, the electrical mechanism comprises, on the one part, a tacho-generator **17** which is operatively connected to the beam **9** through a chain and sprocket assembly **18** and a 25:1 step-up gearbox **19** and, on the other part, a potentiometer **13** which can be actuated also by the beam **9** via a trip-arm **12**, a tie-rod **14**, and a quadrant and pinion assembly **15** against a light tension spring **15***a*. Current to the magnetic clutch **4** can be varied by the control-unit **16** which receives signals from both the potentiometer **13** and the tacho-generator **17**.

The descent of the bottom roller-array causes the tacho-generator **17** to produce an electric signal. This signal is received by the control-unit **16** which in turn causes the electric current to the magnetic clutch to be varied to increase the coupling between the rotor and stator and thereby the braking effect exerted on the supply-roll-shaft **3** in direct relation to the magnitude of the electric signal. As a result of this direct relationship, the velocity of the bottom roller-array during the descent thereof is accurately controlled. As the descent of the bottom roller-array is nearing completion, the potentiometer **13** is actuated by reason of the beam **9** engaging the trip-arm **12**, and a second electrical signal, of increasing magnitude, is received by the control-unit **16**. This in turn causes a further controlled increase in the electric current to the magnetic clutch **4**, whereby the braking force exerted on the supply-roll-shaft **3** is increased. The signal from the potentiometer **13** overrides the reducing signal from the tacho-generator **17** and the bottom roller-array is brought to rest.

Thus, since there is an interrelation between the braking force of the magnetic clutch and the velocity of the bottom roller-array throughout the whole of the descent thereof during replenishment of the supply-magazine, even tension in the web is ensured. There may be slight changes in web tension as the bottom roller-array starts its descent and as it is completing its descent when the potentiometer is actuated to bring the bottom roller-array to rest but, by appropriate adjustment, these changes in tension can be kept to an ineffective minimum.

The control means of the present invention is readily adapted to control the rate of filling and/or emptying of a magazine. It is an advantage of the apparatus that the supply-roll braking control is self-compensating for changes in diameter of the supply roll and that it is not necessary to have a follower arm to sense changes in diameter of the supply roll.

It will be appreciated that the apparatus described above can be applied to provide a substantially constant tension from a continuous source to an interrupted takeup of web or strip material on a re-wind roll. Referring to FIG. **2**, in such instance, a magazine **20** operates in reverse and a rewind roll **21** would be driven by a prime mover (electric motor, not shown) via a magnetic particle clutch **22** operating under slip conditions, and a tacho-generator **23** would be used to control the clutch **22** during emptying of the magazine **20** after a takeup roll had been changed.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. Web material handling apparatus comprising rotatable means for supporting a roll of the material, guide means arranged to guide the material with respect to the roll and to provide a serpentine guide path for the material variable in length between a maximum and a minimum for maintaining a correspondingly variable store of the material therein, said guide means comprising relatively movable arrays of rollers, means responsive to the rate of variation of the length of the guide path for producing a signal representative of said rate, and means responsive to signals from the rate responsive means for controlling rotation of the rotatable means, whereby the relative movement of said arrays of rollers is controlled.

2. Apparatus according to claim **1** wherein the rotatable means is freely rotatable, and wherein the means for controlling rotation of the rotatable means is a signal responsive brake.

3. Apparatus according to claim **1** including means responsive to the relative position of the said arrays of rollers for over-riding signals from said rate responsive means.

4. Apparatus according to claim **3**, wherein the rate responsive means is a tacho-generator, and wherein the tachogenerator is adapted to be driven by relative movement of the arrays of rollers.

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