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(54) Methode of and apparatus for advancing a continuous web.

(57) A method of and apparatus for intermittently advancing a continuous flexible web of material at a substantially constant tension is disclosed. The web of material is unwound from a supply roll, folded longitudinally and drawn past a package forming apparatus by two roll pair assemblies spaced along the path of travel of the web. The diameters of the rolls of the downstream roll pair are greater than the diameters of the rolls of the upstream roll pair so as to impart a constant tension to the web traveling between the two roll pairs to thereby improve the uniformity and yield of the packages formed in the apparatus.

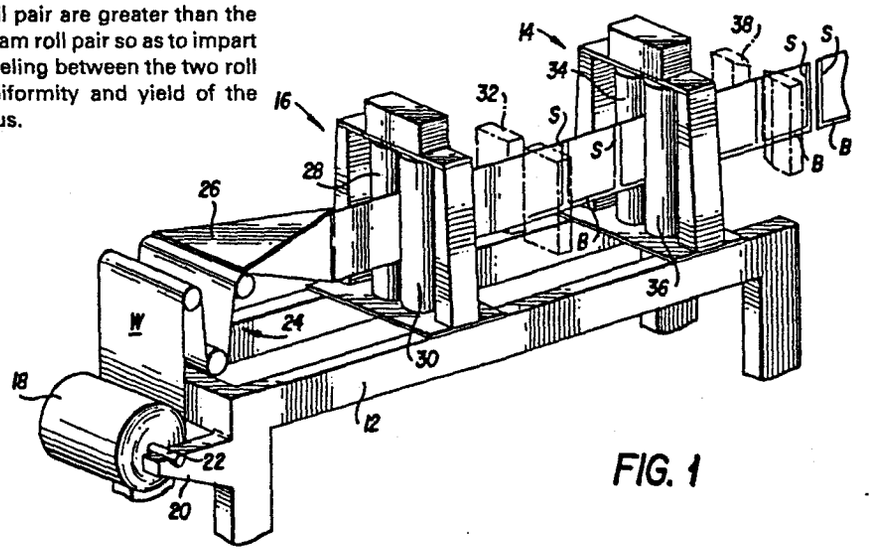

FIG. 1

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METHOD OF AND APPARATUS FOR ADVANCING A CONTINUOUS WEB

Background of the Invention

The present invention relates to a method of and apparatus for feeding a continuous web of material of indeterminate length and, more particularly, to improvements in a form, fill and seal machine known as a Bartelt packaging machine and the manner of operating the same.

In the packaging art, conventional machines, such as, for instance, the Bartelt packaging machine, are used to form a continuous web of laminated sheet material into individual flexible pouch packages, fill the packages with a product and seal the packages. One such packaging machine is disclosed in U.S. Patent No. 2,738,187 and operates in the manner described hereinafter.

In the forming stage, a continuous web of flexible sheet material is unwound from a roll and passed over a set of horizontal idler rollers to a forming plow which folds the web longitudinally along its center line. Downstream of the plow, there is arranged a pair of vertical idler rolls and a seal forming apparatus which impresses a bottom seal and spaced vertical seals, e.g., side seals, in the web material to form a series of interconnected rectangular product pouches.

The web is advanced along its path of travel in increments or steps of equal length by a pair of vertical friction drive rolls disposed downstream of the seal forming apparatus. A cutoff apparatus is arranged downstream of the drive rolls for cutting the folded and sealed web into a plurality of separate flexible pouch packages which are then fed to a product filling station.

Conventionally, web tension is controlled by a friction brake located on the shaft of the sheet material supply roll. The brake may be manually adjusted by the operator to compensate for the changes in tension which result from the continually diminishing weight of the supply roll as the web material is fed from it. However, there is no provision for maintaining web tension when replacing a depleted supply roll.

Because of the indexing or incremental motion of the machine drive, the acceleration/deceleration characteristics of the drive rolls result in a non-uniform or varying web tension which, in turn, results in non-uniformity of pouch widths. Moreover, the lack of tension on the web when a roll is exhausted also results in many wasted pouches at roll changes.

Summary and Objects of the Invention

In view of the foregoing limitations and shortcomings of the prior art devices, as well as other disadvantages not specifically mentioned above, it should be apparent that there still exists a need in the art for a method of and apparatus for controlling the tension in a continuous web fed from a supply roll to a flexible package or pouch forming machine. It is, therefore, a primary objective of the present invention

to fulfill that need by providing a pair of auxiliary friction drive rolls upstream of the main drive roll pair, said auxiliary roll pair being driven by the same drive system as the main drive roll pair to apply a strain or tension to the web passing between the roll pairs.

More particularly, it is an object of the present invention to provide a tension control method and mechanism wherein a continuous web laminate is incrementally fed by two pairs of positively driven friction rolls, the downstream or main pair of rolls having a slightly larger diameter and, thus, a slightly greater peripheral speed than the upstream or auxiliary pair of rolls to create a constant tension in the web.

It is another object of the present invention to provide a flexible pouch forming apparatus with a tension control mechanism which is operable to maintain an incrementally advanced continuous web under constant tension to thereby ensure pouch quality and uniformity and minimize pouch rejects.

Yet another object of this invention is to improve the yield and efficiency of a flexible package forming apparatus.

Still another object of this invention is to provide a method of applying a constant tension to an intermittently advanced continuous laminate web in a flexible pouch forming apparatus.

Briefly described, the aforementioned objects are accomplished according to the method and apparatus aspects of the invention by providing novel improvements in the tension control of a flexible package forming machine of the Bartelt type as described in U.S. Patent No. 2,738,187, the disclosure of which is incorporated herein by reference. The Bartelt

packaging machine comprises a pair of main drive rolls arranged to unwind a continuous, flexible laminate web in incremental lengths from a supply roll, through an idler roll set and past a web folding plow and a vertical (side) and horizontal (bottom) seal forming apparatus.

A pair of vertical auxiliary drive rolls are arranged upstream of the main drive rolls and seal formers and immediately downstream of the folding plow. The nip of the auxiliary drive rolls is aligned with and parallel to the path of travel of the continuous web and the diameter of the auxiliary rolls is slightly smaller than the diameter of the main rolls. Both roll sets are incrementally driven from the main drive shaft and thus rotate at the same RPM.

Because the auxiliary drive rolls are slightly smaller in diameter than the main drive rolls, the peripheral speed of the auxiliary rolls is proportionately lower than the peripheral speed of the main rolls. That difference in peripheral speed imparts a constant tension to the strip of web material spanning the roll pairs. Variations in tension between the feed or supply roll and the auxiliary roll pair have no effect on the tension in the strip of material between the main and auxiliary roll pairs.

The tension control system of the present invention has resulted in substantial improvement of the yield of a roll of laminate material and in the overall efficiency of the apparatus.

With the foregoing and other objects, advantages and features of the invention that will become hereinafter apparent, the nature of the invention may be more clearly understood by reference to the following detailed description of the invention, the

appended claims and to the several views illustrated in the attached drawings.

Brief Description of the Drawings

FIGURE 1 is a partly schematic perspective view of a flexible package forming apparatus constructed according to the present invention; and

FIGURE 2 is a schematic elevation view illustrating the drive means for the main and auxiliary roll pairs.

Detailed Description of a Preferred Embodiment

Referring now in detail to the drawings, there is illustrated in Figure 1 an apparatus 10 according to the present invention for incrementally advancing a continuous web of sheet material. For purposes of illustrating the preferred embodiment, the invention is incorporated in a flexible package forming apparatus known as a Bartelt packaging machine.

The apparatus 10 comprises an elongated frame 12 upon which is mounted a main drive roll assembly 14 and an auxiliary drive roll assembly 16. At one end of the frame 12, a supply roll 18 of a flexible sheet material web W is rotatably mounted in a pair of cantilevered support arms 20. If desired, a friction brake (not shown) may be provided on the supply roll shaft 22 to prevent overrunning or excessive pay-out of web material from the supply roll when the web is unwound from the roll.

As seen in Figure 1, the web W is unwound from the roll 18 upwardly over a conventional idler roll set 24 and travels past a folding plow 26 where it is folded longitudinally along its center line. The

auxiliary drive roll assembly 16 is arranged immediately downstream of the folding plow 26. The rolls 28, 30 of the roll assembly 16 are operated intermittently to withdraw the web W from the supply roll in incremental lengths.

Located between the main and auxiliary roll pairs 14, 16 is a seal forming apparatus 32 which is operative to form spaced vertical (side) seals S and a continuous horizontal (bottom) seal B. The seals S and B define the sides and bottom, respectively, of a series of interconnected flexible pouches or packages which are pulled into the nip of the rolls 34, 36 of the main roll assembly 14. Downstream of the roll assembly 14 there is arranged a cut-off apparatus 38 which is operative to sever the web W along the vertical seals S and thereby separate the individual pouches for subsequent filling and top sealing. The seal forming and cut-off apparatus 32, 38 form no part of the present invention and are, therefore, not illustrated or described in greater detail herein.

In Figure 2, there is schematically illustrated the drive means for the main and auxiliary drive rolls 14, 16. Both roll sets are driven from a common drive shaft 40 which is journaled at its opposite ends in gearboxes 42, 44 which may be fixed to the machine frame 12. Gearboxes 42, 44 house respective bevel gear arrangements 46, 48 which rotate the shafts 50, 52 of the rolls 36, 30 at the same speed.

The shaft 40 is intermittently rotated by an indexing mechanism 54 which is driven by a motor 56 and pulley 58. The details of a suitable indexing mechanism 54 are disclosed in the aforementioned U.S. Patent No. 2,738,187.

The diameters of the rolls 28, 30 of the auxiliary drive roll assembly 16 are slightly less than the diameters of the rolls 34, 36. The difference in roll diameters causes the portion of the folded web spanning the distance between the nips of the roll pairs 28, 30 and 34, 36 to be under a substantially constant strain or tension even during the intermittent advancement or indexing of the roll pairs. The constant tension substantially improves the uniformity and quality of the individual pouches formed on the machine and makes it possible to minimize wastage as the supply roll 18 is depleted and a roll change is required. In an actual embodiment of the invention, the use of auxiliary drive rolls having a nominal diameter of 2.450 inches, or 2% less than the nominal 2.500 inches diameter of the main drive rolls has been successfully operated with a laminate web of metal foil and polymer film. It has also been determined that the objectives of the invention are not accomplished with the aforesaid laminate web when the main and auxiliary rolls have the same nominal diameter or when the diameters of the aforesaid auxiliary drive rolls are less than the diameters of the aforesaid main drive rolls by a magnitude of 4% or greater. The preferred range of diameter differential is 1% to 3%.

Although only a preferred embodiment is specifically illustrated and described herein, it will be appreciated that many modifications and variations of the present invention are possible in light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

WHAT I CLAIM IS:

1. Apparatus for advancing a web of material along a path of travel comprising:

means for supplying the web of material;

a first roll pair arranged along the path of travel of the web;

a second roll pair arranged along the path of travel of the web spaced downstream of the first roll pair, the diameters of the rolls of said second roll pair being greater than the diameters of the rolls of said first roll pair; and

means for driving said first and second roll pairs at substantially the same rotational speed in a direction to advance the web of material along the path of travel.

2. In an apparatus for forming individual packages from a web of sheet material wherein the material web is unwound from a roll and advanced along a path of travel past a package forming means by a pair of main drive rolls rotated at a given speed by a drive mechanism, the improvement comprising an auxiliary drive roll pair arranged along the path of travel upstream of said main drive rolls in driving relation with said web, the diameters of the auxiliary drive rolls being less than the diameters of the main drive rolls and drive means connected to said auxiliary drive rolls for rotating such rolls at substantially said given speed whereby tension is imparted to the portion of said web traveling between said main and auxiliary roll pairs.

3. The improvement according to claim 2, wherein the drive mechanism for said main drive rolls and the drive means for the auxiliary drive rolls are connected to a common drive shaft which is operative to

drive said main and auxiliary rolls at said given speed.

4. The improvement according to claim 2, wherein said common drive shaft is connected to indexing means for intermittently driving said drive shaft such that said web is advanced along said path of travel between the main and auxiliary drive rolls in predetermined increments of length.

5. The improvement according to claim 2, wherein said apparatus includes means for supplying the web to the package forming means and a folding means arranged downstream of the web supplying means for folding said web along the longitudinal center line thereof, said auxiliary drive rolls being arranged immediately downstream of said folding means and upstream of the package forming means.

6. The improvement according to claim 2, wherein the difference in diameters between the main and auxiliary rolls is greater than 0% and less than 4% of the main roll diameter.

7. The improvement according to claim 6, wherein said difference is between 1% and 3% of the main roll diameter.

8. The improvement according to claim 6, wherein said difference is 2% of the main roll diameter.

9. A method of advancing a web of material along a path of travel at a constant tension comprising the steps of:

providing first and second roll pairs spaced along said path of travel, the rolls of said second roll pair having diameters greater than the diameters of the rolls of the first roll pair, said second roll pair being arranged downstream of said first roll pair;

supplying a web of material to said roll pairs; and

applying a substantially constant tension to the web as it travels between said roll pairs by rotating said roll pairs at substantially the same rotational speed.

FIG. 1

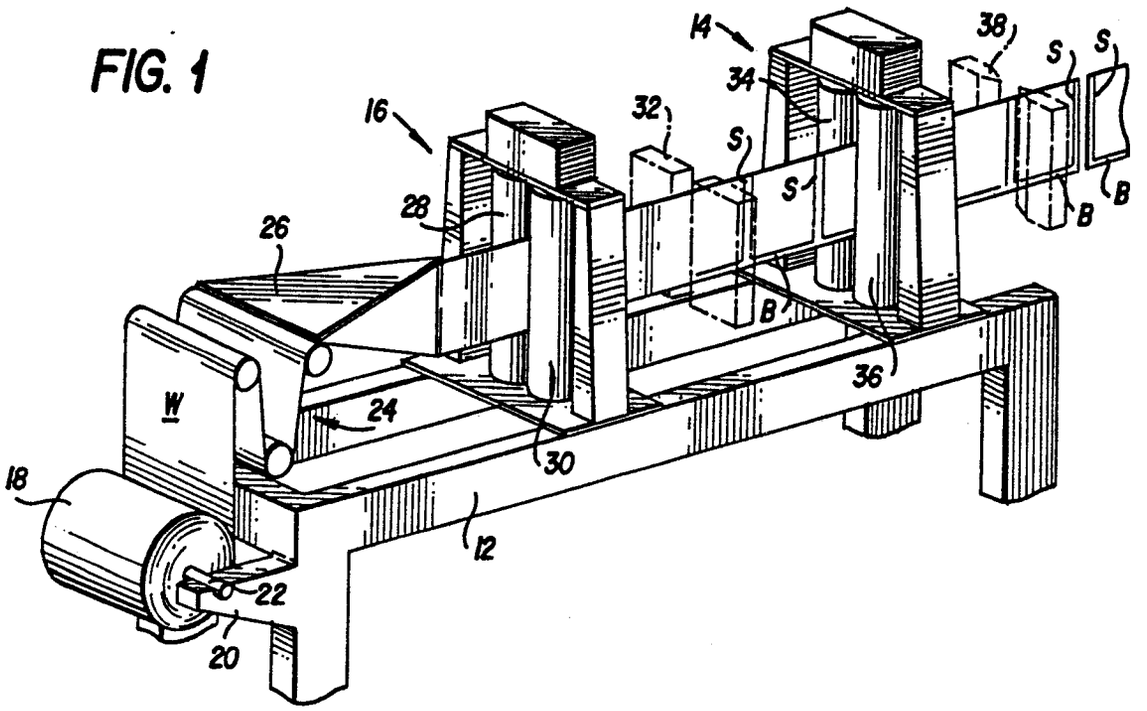
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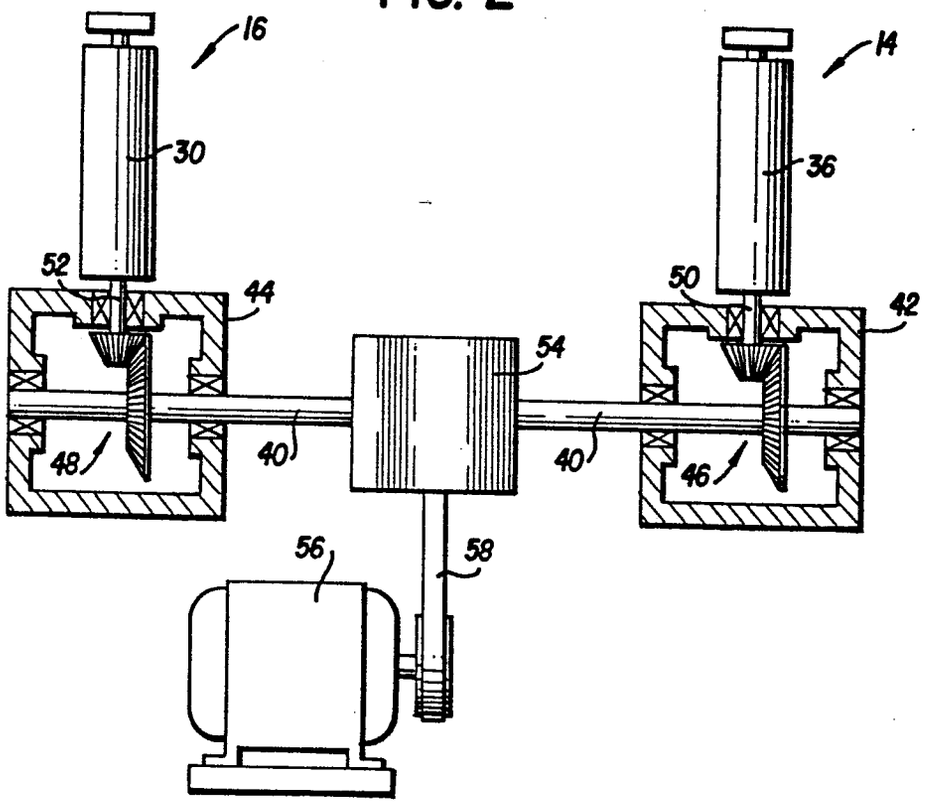
FIG. 2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