METHOD AND APPARATUS FOR PRE-TEARING STRINGS OF AIR-FILLED PACKING MATERIALS

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ABSTRACT

Method and apparatus which facilitate the tearing of packing materials into desired lengths by pre-tearing them along the rows of perforations which are provided for that purpose. In the disclosed embodiments, a preconfigured packing material having inflatable chambers separated by rows of perforations is fed at a predetermined speed in a direction generally perpendicular to the rows and periodically pulled upon rather abruptly to produce a partial tearing of the material along central portions of the rows of perforations.
METHOD AND APPARATUS FOR PRE-TEARING STRINGS OF AIR-FILLED PACKING MATERIALS

BACKGROUND OF THE INVENTION

[0001] 1. Field of Invention

[0002] This invention pertains generally to air-filled packing materials and, more particularly, to a method and apparatus for pre-tearing strings of such materials so they can be more readily separated into desired lengths for use.

[0003] 2. Related Art

[0004] In recent years, air-filled packing materials have come into wide use as a cushioning material or void filler in shipping cartons and the like.

[0005] One of the advantages of such materials is that they can be made from a preconfigured film material which is shipped and stored in a relatively compact form, typically on rolls or folded in boxes, and not inflated until it is at or near the point of use.

[0006] The inflated film material is usually discharged from the machine which inflates it in the form of a continuous string of cushions with lines of perforations between the cushions so that the material can be torn into desired lengths.

[0007] One problem with such materials is that if the perforated areas are made strong enough to get through the machines, it may be difficult to tear the cushions apart.

OBJECTS AND SUMMARY OF THE INVENTION

[0008] It is, in general, an object of the invention to provide a new and improved method and apparatus for making air-filled packing materials.

[0009] Another object of the invention is to provide a method and apparatus of the above character which facilitate the tearing of perforated materials into desired lengths.

[0010] These and other objects are achieved in accordance with the invention by providing a method and apparatus which facilitate the tearing of packing materials into desired lengths by pre-tearing them along the rows of perforations which are provided for that purpose. In the disclosed embodiments, a packing material having inflated chambers separated by rows of perforations is fed at a predetermined speed in a direction generally perpendicular to the rows and periodically pulled upon rather abruptly to produce a partial tearing of the material along the rows of perforations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is an isometric view of one embodiment of a system for pre-tearing and inflating strings of air-filled packing cushions in accordance with the invention.

[0012] FIG. 2 is a perspective view of the machine which inflates and seals the film material in the embodiment of FIG. 1.

[0013] FIG. 3 is top plan view, partly broken away, of the preconfigured film material which is pre-torn and inflated in the embodiment of FIG. 1.

[0014] FIG. 4 is a fragmentary isometric view of the embodiment of FIG. 1, with the covers of the pre-tear unit removed.

[0015] FIG. 5 is a fragmentary elevational view of the pre-tear mechanism in the embodiment of FIG. 1.

[0016] FIG. 6 is an isometric view of the drive mechanism of the pre-tear unit in the embodiment of FIG. 1.

DETAILED DESCRIPTION

[0017] In the drawings, the invention is illustrated in connection with a system which includes a machine 11 for inflating and sealing a preconfigured film material 12 to form strings of air-filled packing cushions 13. The system also includes a bin 14 positioned to receive the strings of cushions from the machine, and a dispensing head 16 through which the strings of cushions are withdrawn from the bin.

[0018] The inflating and sealing machine can, for example, be of the type shown in U.S. Pat. No. 6,582,500, the disclosure of which is incorporated herein by reference. This machine has a base plate 17 which is adapted to rest on a table top or bench, and a generally rectangular enclosure housing 18 mounted on the base plate. The material is fed through the machine by a pair of traveling belts 19 which are trained about drive rollers 21, take-up rollers 22 and guide rollers 23-26. The belts are positioned on opposite sides of the path of the film material, with only the upper belt being visible in FIG. 2. The lower belt is identical to the upper one, but inverted so that the two belts are positioned symmetrically about the film path.

[0019] Air is injected into the material before it reaches the belts by an inflation tube 27 which extends in a generally horizontal direction near the front wall of the housing. Air is supplied to the inflation tube at a pressure on the order of 3 psi by a pump located within the housing and discharged into the film material through a plurality of openings (not shown) in the side wall of the tube. A knife blade (not shown) is provided for slitting the film material along the inflation tube after the material is inflated and sealed to permit the material to separate from the tube.

[0020] Heater blocks 28 are positioned adjacent to the belts on both sides of the film path for applying heat to the material through the belts to seal the material after it is inflated. The heater blocks are movable between a rest position away from the belts and a sealing position against the belts. They are urged together toward the sealing position by springs 29, and are moved apart by a cam mechanism (not shown).

[0021] Covers 31, 32 on the front wall of the housing enclose the belts, rollers and heater blocks and thereby protect the operator as well as keeping the film material away from the sides of the heater blocks. In the embodiment illustrated, upper cover 31 is formed as an integral part of the housing, and has a transparent window 33 in its outer wall. The two covers are spaced apart to form an opening 34 through which the edge portion of the film material can pass as the material travels along the inflation tube and between the belts.

[0022] An opening 36 is formed in the lower corner of the window and the upper corner of the lower cover to facilitate insertion of the material into the machine, and a knife 37 is mounted on the upper cover for trimming the corner off the film material to make it easier to thread the material onto the inflation tube.
As illustrated in FIG. 3, the film material 11 is in the form of an elongated length of flattened plastic tubing 39, such as polyethylene, with rows of perforations 41 extending transversely across the tubing from one edge to the other. Between the rows of perforations, the two layers 43, 44 of the flattened tubing are sealed together along lines 46, 47 which extend from one edge 48 of the tubing in a direction generally parallel to the perforations and terminate a short distance from the second edge 49. Each pair of seal lines 46, 47 defines an air chamber 51 which has an open mouth 52 that communicates with a longitudinally extending inflation channel 53 which is formed between the ends of the seals and the second edge of the material. A similar material is shown in U.S. Pat. No. 6,582,800.

The film material is wound into a supply roll 56 which is mounted on a mandrel or spindle 57 for rotation about a horizontally extending axis above and to one side of the inflating and sealing machine.

A pre-tear unit 59 is positioned between the supply roll and the inflation and sealing machine for tearing the material along the central portions of the rows of perforations before it is inflated and sealed. The pre-tear unit is enclosed in a housing 61 which has a pair of removable covers 62 on opposite sides of the film material.

As best seen in FIG. 5, the pre-tear unit includes a pair of horizontally extending input guides 63, 64 positioned on opposite sides of the film material, a pair of feed rollers 66, 67 which draw the material from the supply roll, and a pair of tear rollers 68, 69 which receive the material from the feed rollers.

The feed rollers engage opposite sides of the film material and are driven in unison by a pair of gears 71, 72 mounted on roller shafts 73, 74. Tear rollers 68, 69 also engage opposite sides of the film material and are driven in unison by gears 76, 77 mounted on their shafts 78, 79. The rollers are driven by a drive motor 81 which is connected to the shaft of tear roller 68 and a drive chain 82 trained about sprockets 83, 84 affixed to drive gears 71, 76. The sprockets are sized such that the tear rollers turn somewhat faster than the feed rollers, and in one present embodiment, sprocket 83 has 30 teeth, sprocket 84 has 24 teeth, and the tear rollers rotate about 25 percent faster than the feed rollers.

Tear roller 69 has an interrupted surface with flat sections 86 spaced in quadrature between arcuate sections 87. This roller is thus adapted to engage the film material and pull upon it on an intermittent or periodic basis. Because the tear rollers are traveling substantially faster than the feed rollers, the pull is a rather abrupt one which tears the material apart along the rows of perforations. The rollers engage a central portion of the material, midway between edges 48, 49, and hence the tearing occurs in the central portions of the rows of perforations, resulting in laterally extending slots or gaps 89 between the cushion chambers.

The material emerging from the tear rollers is trained about a horizontally extending bar 91 affixed to a switch arm 92 which pivots about a pin 93. It then passes over a guide rod 94 to inflating and sealing machine 11. A magnet 96 is mounted on the switch, and the position of the arm is monitored by a sensor (not shown) which controls the operation of drive motor 81, with the drive motor being turned off if the mater is not being pulled by the inflating and sealing machine.

Dispensing head 16 has a generally rectangular frame 98 which is mounted in an elevated position on a post 99 next to bin 14. A horizontally extending guide roller 101 is mounted on a bracket 102 toward the top of the post, and the dispensing head has a roller 103 mounted between the side rails 104, 106 of the frame and a plurality of elongated, flexible bristles 107 which extend from the upper rail 108 and terminate just above roller 103.

Operation and use of the system, and therein the method of the invention can now be described. The supply roll 56 of preconfigured film material is placed on mandrel 57, and the free end of the material is threaded through pre-tear unit 59. That unit then draws the material from the supply roll, and the free end of the material is threaded about switch arm bar 91 and over guide rod 94. It is then threaded onto the inflation tube 27 and engaged with belts 19 in the inflating and sealing machine. The pre-tear unit continues to draw the material from the supply roll, and the belts draw the material from the pre-tear unit and feed it through the machine. If the machine stops pulling the material, switch arm 92 will rotate in a counterclockwise direction, tripping the sensor which shuts off the drive motor in the pre-tear unit, which serves to regulate the speed of the material through the system.

As the material passes through the pre-tear unit, feed rollers 66, 67 engage the central portion of the material continuously and feed the material at a substantially steady speed toward tear rollers 68, 69. The tear rollers are traveling at a higher speed, and engage the material only intermittently or periodically. When they do, they exert a rather abrupt tug or pull on the central portion which tends to tear the in the central portions of the areas of weakness formed by the rows of perforations.

The material is fed through the inflating and sealing machine with inflation tube 27 being received in the inflation channel 53 and air from the tube being injected through the open mouths 52 into chambers 51 to inflate the cushions. Heating elements 28 then form a longitudinally extending seal across the mouths of the chambers, thereby sealing the chambers to retain the air in them. After the cushions are inflated and the chambers are sealed, the material is slit along the inflation channel to permit it to separate from the inflation tube.

The inflated cushions 13 are discharged into bin 14 in the form of a continuous string, and stored in the bin until they were used. They are withdrawn from the bin, trained over roller 101, and passed between the bristles 107 and roller 103 of dispensing head 16. The bristles permit the cushions to be withdrawn from the bin without tearing apart if the string of them is pulled steadily. However, they also provide some resistance to the movement of the string such that the pre-torn cushions can be torn apart in desired numbers simply by snapping down on the string. This can be done with one hand, which is a significant improvement and advantage over the prior art where the cushions had to be grasped with both hands and torn laterally in order to separate them.

The centrally located slots or openings produced by the pre-tear unit also have another advantage in that they allow the central portions of the cushions to be drawn in and rounded as they are inflated, which allows them to hold about 20 percent more air than they could without the slots.
It is apparent from the foregoing that a new and improved method and apparatus for pre-tearing strings of air-filled packing materials have been provided. While only certain presently preferred embodiments have been described in detail, as will be apparent to those familiar with the art, certain changes and modifications can be made without departing from the scope of the invention as defined by the following claims.

1-17. (Canceled)

18. Apparatus for making a packing material in the form of a string of air filled packing cushions with rows of perforations extending across the material between the cushions, comprising: means for feeding two superposed layers of film material in which the perforations have been formed along a path, means engagable with the film material for partially tearing the material along the rows of perforations, means for injecting air between the two layers of film material, and means for sealing the layers of film material together to form air-filled cushions between the partially torn rows of perforations.

19. The apparatus of claim 18 wherein the means for partially tearing the material comprises a tear roller having an arcuate section which periodically engages a central portion of the material and a section adjacent to the arcuate section which remains out of driving engagement with the material.

20. The apparatus of claim 19 wherein the means for partially tearing the material also includes a feed roller with a surface in continuous driving engagement with the film material for feeding the material at a predetermined speed.

21. The apparatus of claim 20 wherein the tear roller rotates faster than the feed roller.

22. A method of making a packing material in the form of a string of air-filled packing cushions with rows of perforations extending across the material between the cushions, comprising the steps of: feeding two superposed layers of film material in which the perforations have been formed along a path, partially tearing the material along the rows of perforations, injecting air between the two layers of film material, and sealing the layers of film material together to form air-filled cushions between the partially torn rows of perforations.

23. The method of claim 22 wherein the material is torn by continuously engaging a central portion of the film material with a feed roller to feed the material at a predetermined speed, and periodically exerting an abrupt pull on the material by engaging an edge portion of the material with a tear roller having an interrupted surface with an arcuate section which engages the material to exert the pull only during a portion of a rotation of the roller.

24. Apparatus for making a string of air-filled packing cushions from an elongated strip of preconfigured film having a plurality of un inflated chambers formed between two layers of the film with rows of perforations extending across the film between successive ones of the chambers, comprising: means engagable with a central portion of the film for feeding the film along a path at a predetermined speed, a tear roller having a surface that rotates faster than the predetermined speed and is intermittently engagable with a central portion of the film for exerting an abrupt periodic pull on the film which produces a partial tearing of the film along the central portions of the rows of perforations, means for injecting air between the layers of film after the material is partially torn along the rows of perforations to inflate the chambers, and means for sealing the chambers to retain the air therein.

25. The apparatus of claim 24 wherein the surface of the tear roller has an arcuate section which periodically engages the central portion of the film and a section adjacent to the arcuate section which remains out of driving engagement with the film.

26. The apparatus of claim 24 wherein the means for feeding the material at a predetermined speed comprises a feed roller with a surface in continuous driving engagement with the film.

27. The apparatus of claim 26 wherein the tear roller rotates faster than the feed roller.

28. A method of making a string of air-filled packing cushions from an elongated strip of preconfigured film having a plurality of uninflated chambers formed between two layers of the film with rows of perforations extending across the film between successive ones of the chambers, comprising the steps of: feeding the film along a path at a predetermined speed, intermittently engaging a central portion of the film with a tear roller having a surface that travels faster than the predetermined speed for exerting an abrupt periodic pull on the film which produces a partial tearing along central portions of the rows of perforations, injecting air between the layers to inflate the chambers, and sealing the chambers to retain the air therein.

29. Apparatus for pre-tearing a film material having a plurality of longitudinally spaced sections with rows of perforations extending across the material between successive ones of the sections, comprising: means for continuously feeding the film material at a predetermined speed, and a continuously rotating tear roller having a surface that travels faster than the predetermined speed and periodically engages a central portion of the material and exerts an abrupt periodic pull on the material which produces a partial tearing of the material along central portions of the rows of perforations.

30. The apparatus of claim 29 wherein the surface of the tear roller has an arcuate section which periodically engages the central portion of the material and a section adjacent to the arcuate section which remains out of driving engagement with the material.

31. The apparatus of claim 30 wherein the means for feeding the material at a predetermined speed comprises a feed roller with a surface in continuous driving engagement with the material.

32. The apparatus of claim 31 wherein the tear roller rotates faster than the feed roller.

33. A method of pre-tearing a film material having a plurality of longitudinally spaced sections with rows of perforations extending across the material between successive ones of the sections, comprising the steps of: engaging the material with a feed roller to continuously feed the material at a predetermined speed in a direction generally perpendicular to the rows of perforations, and engaging a central portion of the material with a tear roller that rotates about a stationary axis and has an eccentric surface travels faster than the predetermined speed and periodically engages the film material to exert an abrupt periodic pull on the material to produce a partial tearing of the material along central portions of the rows of perforations.