METHOD OF PRODUCING CUSHIONING DUNNAGE

14 Claims, 32 Drawing Figs.

ABSTRACT: A method of producing coiled, resilient cushioning dunnage comprising taking a web of sheetlike material, such as paper, of predetermined width and crumpling it down into a relatively narrow strip and then forming the strip by pressure into generally helically coiled form. Also a method of producing elongated, tubularlike dunnage is disclosed which comprises taking a web of flexible sheetlike material, such as paper, of predetermined width and forming the web into a generally tubularlike shape by moving the lengthwise edges of the web inwardly toward one another and then loosely crumpling the inwardly turned web and stitching the article along the lengthwise extent thereof to maintain it in its formed configuration.

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Inventor
George R. Johnson
Chagrin Falls, Ohio

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Assignee The Arpax Company
Chagrin Falls, Ohio

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Method of Producing Cushioning Dunnage

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Primary Examiner—Wayne A. Morse, Jr.
Attorney—Baldwin, Egan, Walling & Fetzer

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METHOD OF PRODUCING CUSHIONING DUNNAGE

This is a divisional application of my copending U.S. Pat. application, Ser. No. 640,145 filed May 22, 1967, now U.S. Pat. No. 3,509,797 issued May 5, 1970, by George R. Johnson and entitled MECHANISM AND METHOD FOR PRODUCING DUNNAGE.

This invention relates in general to methods for producing packing material or cushioning dunnage as it is known in the art, and more particularly dunnage producing methods embodying procedures for converting a continuous web of sheet-like material such as paper, into generally resilient lengths of dunnage for use in packing and cushioning articles or products in shipping containers and the like.

Various mechanisms and methods are known in the art for producing lengths of packing material for use in packing fragile or breakable articles in enclosing containers. One such mechanism is disclosed in U.S. Pat. No. 2,882,802 issued April 21, 1959 to Charles J. Walker and entitled CRUMPLING DEVICE. However, such prior art mechanisms and methods are either too complex for the quality of dunnage produced or they do not produce dunnage for packing material which has suitable resiliency, for giving good cushioning protection to articles disposed in shipping containers. Accordingly, the general practice has been to crumple paper material manually with packers crumpling the material and inserting it into the containers as needed. The latter method is inefficient and time consuming. Various other types of dunnage, such as for instance, plastic dunnage are known in the art, but these other types generally either require too much storage space or are too expensive for universal use.

The present invention provides novel methods for effectively and efficiently producing paper dunnage, the latter having considerable resiliency for greatly improving the cushioning characteristics of the packing material or dunnage. The invention also provides novel and economical methods of producing packing material or dunnage which has resiliency characteristics heretofore unknown.

Accordingly, an object of the invention is to provide a novel method for producing dunnage or packaging material.

A further object is to provide a method of the latter type which includes crumpling sheetlike material, such as paper, into relatively narrow strip form and then forming the strip into helically coiled form.

A further object of the invention is to provide a method of producing cushioning dunnage from sheetlike material including crumpling the sheetlike material through crumpler means and then through intermeshing gear means to form the sheetlike material into a relatively narrow strip while intermittently compressing the strip of crumpled sheet material.

A still further object of the invention is to provide a novel method including taking sheetlike material from a roll, crumpling the sheetlike material into an elongated continuous strip and coiling the strip of material into permanent irregular helical coiled form.

A further object of the invention is to provide a novel method including taking a plurality of webs of sheetlike material and combining and forming the plurality of webs into an integral highly resilient dunnage product of tubular padlike construction.

A still further object of the invention is to provide a novel method for making cushioning dunnage and which utilizes sheetlike stock material for producing the dunnage with such sheetlike stock material being able to be stored in compact dense condition requiring relatively little cubic feet for storage, and which stock material is expanded many times over in the formation of the latter into a dunnage product, and wherein the method or process can be effectively utilized at the point of packing operations for efficient transmittal of the resilient dunnage product directly into the containers being packed.

A further object of the invention is to provide a novel method for making cushioning dunnage which comprises taking paper sheet stock material and engaging it from one side thereof to concave the sheet material in a direction transverse thereof to urge the sheet material toward generally tubularlike configuration, radially crumpling the tubularlike product, and then stitching the tubularlike product lengthwise thereof to maintain it in resilient tubularlike form.

A further object is to provide the latter method utilizing a plurality of sheets of paper stock material in coaging engaged relation to form the resilient tubularlike product.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a diagrammatic front elevational view showing one embodiment of the invention with the sheetlike material being drawn through crumpler means in the form of a funnellike mechanism, to form an elongated crumpled strip or rope of material for dunnage;

FIG. 2 is a side elevational view of the FIG. 1 mechanism;

FIG. 3 is an enlarged top plan view of a section of the dunnage strip as formed by the mechanism of FIGS. 1 and 2;

FIG. 4 is an enlarged sectional view of the dunnage strip taken generally along the plane of line 4-4 of FIG. 3, looking in the direction of the arrows;

FIG. 5 is a generally diagrammatic perspective illustration of a dunnage producing mechanism illustrating a preferred embodiment thereof, and one utilizing miter bevel gears for drawing the sheet material through crumpler means, to form the resultant relatively narrow strip or rope of material into coiled or spiral form;

FIG. 6 is a top plan, diagrammatic illustration of the mechanism illustrated in FIG. 5;

FIG. 7 is a reduced size, fragmentary perspective view of the mechanism illustrated in FIGS. 5 and 6, and illustrating a kinker mechanism coacting therewith, for preventing the strip of dunnage from being coiled into a spiral or regular helical form, so as to reduce the density of the dunnage;

FIG. 8 is an elevational view of a section of the dunnage formed by the mechanism of FIGS. 5 through 7;

FIG. 9 is a sectional view taken along the plane of line 9-9 of FIG. 8;

FIG. 9A is a fragmentary, enlarged elevational view of a section of the dunnage of FIG. 8 showing the generally corrugated configuration thereof;

FIG. 10 is a fragmentary elevational, generally diagrammatic view illustrating a mechanism adapted for use with the dunnage mechanism of FIGS. 5 and 6 for producing predetermined weights or a quantity or slug (as they will be hereinafter called) of the dunnage material;

FIG. 11 is a diagrammatic, sectional view of a shipping container with an article packed therein with a quantity of the dunnage material illustrated in FIG. 8;

FIG. 12 is a fragmentary elevational view generally similar to FIG. 1 but illustrating another embodiment of the invention, and one utilizing spur gear means for drawing the sheetlike material through the crumpler mechanism, to produce a strip or rope of coiled or intermittently compressed dunnage;

FIG. 13 is a fragmentary side elevational view of the FIG. 12 mechanism;

FIG. 14 is an enlarged top plan view of a section of the dunnage produced by the mechanism of FIGS. 12 and 13;

FIG. 15 is a side elevational view of the dunnage of FIG. 14;

FIG. 16 is a top plan view of a piece of dunnage produced in a dunnage mechanism generally similar to that of FIGS. 12 and 13 but wherein helical gears are utilized instead of spur gears, for drawing the sheetlike material through the crumpler and to coil the strip of dunnage;

FIG. 17 is a fragmentary, enlarged diagrammatic illustration of another embodiment of dunnage producing mechanism utilizing a belt driving on a spiral like rod or mandrel, for forming a strip or rope of sheetlike material, which has been previously formed into strip or rope form by a crumpler or folder means, into a coiled strip or rope of dunnage;

FIG. 18 is a reduced size, top plan view of the mechanism illustrated in FIG. 17;

FIG. 19 is a side elevational view of the FIG. 18 mechanism;
FIG. 20 is an enlarged, perspective, fragmentary view of a piece of the sheetlike material as folded into striplike or rope-like form by the crumper or folder means of the FIG. 17 mechanism;

FIG. 21 is an enlarged, fragmentary, illustration of a section of the coiled dustage as formed by the spiral mander and coating belt of the FIG. 17 mechanism;

FIG. 22 is a reduced size, generally diagrammatic illustration of the belt utilized in the FIGS. 17-19 mechanism and illustrating the full twisted formed in the belt for effective coaction with the spiral mander for producing the cooled configuration of dunnage;

FIG. 23 is a partially broken front elevation of a further embodiment of dunnage producing mechanism and one utilizing a plurality of webs of sheetlike material for forming a resilient tubularelike dunnage product of low density;

FIG. 24 is a partially broken side elevational view of the FIG. 23 embodiment;

FIG. 25 is an elevational view of a section of dunnage produced by the dunnage producing mechanism of for instance FIGS. 5-7, and wherein the formed coils are not as tight as those of the FIG. 8 dunnage, and the strip or rope of paper material is not compressed to the extent of that of the FIG. 8 dunnage;

FIG. 26 is a sectional view taken generally along the plane of line 26-26 of FIG. 25;

FIG. 27 is an elevational view of a section of tubularlike dunnage produced by the mechanism of FIGS. 23 and 24;

FIG. 28 is a sectional view taken generally along the plane of line 28-28 of FIG. 27;

FIG. 29 is an elevational view of a modified form of tubularlike dunnage, which is coined only on one lengthwise edge thereof instead of on both lengthwise edges as in the FIG. 27 embodiment;

FIG. 30 is a sectional view taken generally along the plane of line 30-30 of FIG. 29;

FIG. 31 is a diagrammatic top plan view of the geared cutter mechanism of the FIGS. 23 and 24 machine, illustrating the cutting geometries thereof.

Referring now again to the drawings, FIG. 1 illustrates a roll 10 of sheetlike material 14 supported on trunnions 10A with a crumper means 12 being preferably disposed in generally vertical downwardly spaced relation to the roll 10, and through which the sheetlike material 14 is adapted to move to form such sheetlike material into a relatively narrow continuous strip or rope 16. A suitable sheetlike material has been found to be Kraft paper having a density of 47.5 pounds per cubic foot. It will be understood however that other types of papers and other sheetlike materials would also be satisfactory.

The crumper mechanism 12, in the embodiment illustrated, comprises a funnellike device having a widened mouth portion 18 and a relatively narrow discharge end portion 20, thereby causing a gathering of the sheetlike material 14 as it comes off the roll and formation of such material into a relatively narrow strip or rope as it exits from the discharge end 20.

Means 22 may be provided for pulling the sheetlike material through the crumper 12, and in the embodiment illustrated such means comprises a pair of rotatable rolls 24, 24A (such as rubber rollers) which may be drivingly connected to one another by means of gearing 26 at the ends thereof, and with one of said rolls (e.g. 24) being operatively coupled to a preferably variable speed, power unit 28, such as an electric motor, for rotating the rolls.

It will be seen that upon energization of the motor 28, the rolls 24, 24A are driven to cause drawing of the sheet material through the crumper 12. The outer surfaces of the rolls 24, 24A may be serrated, especially if they are formed of a material of low coefficient of friction, so as to increase the frictional coaction with the strip emitting from the discharge end 20 of the crumper. A braking device comprising in the embodiment illustrated a strip of material 29 anchored as at 29A and coacting in frictional engagement with roll 10, may be provided to prevent overrunning of the roll. As will be seen weight 30 at-tached to strip 29, maintains the frictional coaction between the roll 10 and strip 29. As can be best seen in FIG. 2 as the relatively narrow rope or strip 16 of material passes through or is drawn between the rolls 24, 24A, such rope or strip is preferably reduced in thickness and may increase slightly in width. However, it will be understood that the strip of material after it passes between the rolls 24, 24A still has resiliency thereto due to the multitude of crumpled folds of material, (FIG. 4) and thus is not in a totally flattened and nonresilient condition. Preferably the spacing between rolls 24, 24A is adjustable so that the degree of flattening of the strip 16 can be varied. As can be seen from FIGS. 3 and 4, the finished generally flattened strip of dunnage material is of generally irregular configuration and is formed of plies or folds of the sheet material 14 as it is crumpled together by the crumper mechanism 12.

A cutter mechanism 31 of any suitable type may be provided for cutting the strip of crumpled material after it is formed by crumpler 12 and rolls 24, 24A, into suitable length sections for use as dunnage. Such cutter mechanism may comprise a conventional pivotal knife which may be either manually or power operated, and preferably is under the selective control of the operator. The dunnage strip sections may be of any desired length, and may be fed from the dunnage producing mechanism directly into the shipping container or the like in which articles are being packed, or such dunnage strip may be cut into predetermined length sections, and then placed in the shipping container in mass.

Referring now to FIGS. 5 and 6 which illustrates a preferred embodiment of the dunnage producing mechanism, such mechanism may comprise a support 34 for mounting a roll 10 of the sheetlike material 14, with such support 34 being preferably adjustable with respect to the platform 36, upon which the support may be mounted and preferably being adapted to accommodate a variety of roll widths. The crumper means 38 of the FIG. 5 mechanism may comprise a funnellike arrangement somewhat similar to that in the first embodiment having a widened mouth and a relatively narrow discharge nozzle portion 39 and with such sheetlike material being adapted to be pulled though the crumper means by coating bevel gear mechanism 40 which may be rotatably mounted on platform 36. In the embodiment illustrated, the bevel gear mechanism is miter gearing and the axis of the nozzle 39 is disposed at an angle of approximately 37 ½° with respect to the horizontal. One of the bevel gears (e.g. 40A) may be drivingly coupled to a geared speed reducer 42 as by means of belt and pulley mechanism 44 which in turn may be coupled to a power means, such as a preferably variable speed electric motor 46. The other miter gear 40B is adapted to coat in meshing relation with gear 40A. Gears 40A, 40B are preferably adjustably mounted so that the degree of meshing can be selectively varied, and as by means of nuts 48 in threaded relation with threaded portions of associated shafts 50 rotatably mounting the respective gear 40A or 40B. In other words, each gear is preferably adjustable in an axial direction, so as to vary the meshing relation between gears 40A, 40B.

The sheetlike material 14 is adapted to be pulled from the roll 10 thereof through the crumper 38 by the coating gears 40A, 40B, and as it passes between the rotating gears, the strip is coiled or formed by the teeth of the gears as diagrammatically illustrated at 52 in FIG. 8. Moreover passage of the strip of material between the bevel gears causes the strip to be coiled as it passes through the gears so that it takes the form of spiral springlike loops 54 which loops have considerable resiliency and thus afford an extremely effective type of packing for use in shipping containers and the like.

The crumper means 38 is preferably adjustably mounted for generally horizontal movement with respect to the gear mechanism so that the discharge end of the nozzle can be moved toward and away from the meshing gears for varying the "overshoot" of the strip or rope of crumpled sheet material emitting from the nozzle. Speaking generally, the closer the
nozzle is moved in a forward direction toward the center of engagement of the miter gears, the greater the "overshoot" of the cramped strip with respect to the gears, and the less of the material of the cramped rope or strip that actually passes between the teeth as compared to a smaller (smoother) spiral path. In one embodiment of the invention, the greater "overshoot" of the coiled strip is caused by the rotation of the miter gears, and the greater "overshoot" of the material from the coiled strip is caused by the rotation of the miter gears, resulting in a greater "overshoot" of the coiled strip than in other embodiments of the invention. In other words, the exit end of the nozzle 39 is relatively close to the center of engagement of the miter gears.

Now, in order to insure that the corrugated or ribbed strip material being emitted from between the gears in coiled form will not be formed into regular coils or spirals but will be provided with the aforementioned kinks malformed portions 60, a means may be provided for interrupting the regular spiral formation of the dunnage strip produced from its passage through the bevel gears, and causing the strip of material to be kinked or reversed in its spiral formation, thus interrupting the regular coil configuration being formed by the gears. It will be understood that as the strip of material is emitted in generally spiral form from between the gears 40a, 40b, the lower end of the spiral strip is moving in a generally rotary path about the lengthwise axis of the spiral. Accordingly, in order to interrupt the formation of a regular spiral or helical configuration, a resistance to this rotary movement of the lower portion of the spiral strip results in the formation of the malformed or kinked portions 60 of the dunnage strip.

This means for applying a resistance or interruption of the regular spiral production of the strip in the embodiment illustrated in FIG. 7, comprises a cylindrical like housing 66 open at the top thereof and encompassing the shieding means 56 and which has an openable bottom wall 66a pivoted as at 67 to the housing so that as the strip of material coils down the gears, the friction between the teeth thereof with bottom wall 66a will cause a reversal of the regular coiling formed by the gears, thus making the malformed portions 60 in the spiral strip. The bottom wall may be counterbalanced as at 70, so that upon relatively slight predetermined pressure due to engagement of the spiral dunnage with the door, the door will tip downwardly about its pivot and permit the coiled material to be emitted from the housing 56. Housing 56 is preferably readily detachable from coaction with the dunnage mechanism for ease in assembling and removal.

A work bench 74 (FIG. 5) may serve as the kink producing means instead of housing 56, since engagement of the lower rotating end of the spiral strip with the top surface of the work bench will produce a resistance or drag on the spiraling movement of the strip resulting in malformed or kink portions 60. Also stuffing or handling of the dunnage into a container for packing while the machine is running will also produce the kinked or malformed portions of the dunnage product.

It will be understood that the number of coils or spirals in a predetermined length section of the coiled dunnage before kinking and reversal thereof is not necessarily uniform, since it depends on how much resistance is provided to the turning or rotation of the lower end of the strip, as it passes down between the bevel gears. Other factors appear to be the width of the strip or rope of material as it comes from the crumpler mechanism and the size of the bevel gears, so that there are certain variables which can enter into the formation of the dunnage to affect its ultimate coil configuration. Miter gears with 1.5 inches to 2 inches pitch diameter and having respectively 18 and 20 teeth have been used to produce highly effective dunnage. As can be seen in FIG. 11 when the dunnage is compressed it does not collapse into regular coil form due to the fact that the coils are not all symmetrically formed into a symmetrical helix, but due to the irregular configuration of the dunnage sections due to the malformed portions or sections 60, the dunnage resists collapsing and becomes a resilient mass when packed in a container, which gives good cushioning to articles packed in the dunnage.

From FIG. 9 it can be seen from the cross section of the dunnage strip that the latter is formed of layers or folds of the sheetlike material or paper as compressed between the teeth of the gears, with the teeth having coined the dunnage strip into generally wavellite or corrugated form in a direction generally crosswise of the strip, and as shown in FIG. 9A a view taken in a tangential and highly resilient mass of dunnage. Thus it will be seen that the dunnage strip sections do not completely collapse but from an irregular configuration for giving less density and greater resiliency to the dunnage mass.
ment between the gears (say for instance, one-eighth inch back from the center of engagement) and the gear teeth have an overlap of approximately one thirty-second of an inch for a loose mesh relation. Such dunnage product 75 is of low density, with the intermediate layers 75a of material being loosely formed in the interior of the outer layer, giving the product low density and high resilience. The increased "overshoot" produces an enlarged end portion 77 (in a direction transverse of the product) which tapers or converges toward the other end. Enlarged or unsqueezed portion 77 is formed due to the fact that with a relatively great overshoot and a loose mesh relation, the forward edge of the rope or strip from the crumpler passes outside or forwardly of the gear teeth and thus is not coined or squeezed, while the tapered portion passes between the teeth and is coined or squeezed. However, the loose mesh of the gears coins the rope or strip materially less than that of the FIG. 8 dunnage product.

FIG. 10 discloses a mechanism for weighing out a predetermined weight or slug (as it is hereinafter referred to) of the dunnage material, as produced by the dunnage mechanism of FIGS. 5 and 6. This mechanism would be usually used in repetitive packaging requiring the same amount of dunnage. Such mechanism may comprise a metering housing 78 open at the top thereof, and which encloses the gears 40a, 40b and the aforementioned shield 56, and into which the dunnage strip as it comes down from between the gears, is adapted to drop. The bottom wall 78a of the housing may be pivoted to the horizontal mounting member and may have such a counterweight mechanism 80 thereon so that after a predetermined weight of the strip dunnage has gathered in the housing, the bottom wall is forced open and the slug of dunnage material passes downwardly onto a supporting surface or work table 82. The bottom wall then recoiles due to the removal of the weight of the dunnage therefrom, and the strip may be cut by means of a blade to the desired length and another slug of dunnage is being formed in the housing. Kinking or malformation of the dunnage occurs in housing 78 in the manner aforesaid.

The interior of the housing is preferably completely smooth so that the slug of dunnage has nothing to catch on in the housing 78, so that when the bottom door pivots downwardly the slug of dunnage readily falls downwardly out of the housing. The counterbalance may comprise a hollow tube 80a having ball weights (not shown) rollingly mounted therein to increase the sensitivity of the wall 78a and provide for quick dumping and more accurate weighing. In the closed condition of wall 78a, the weighted end of tube 80a may be disposed slightly below the horizontal, with a stop being provided to limit the movement of the wall 78a and associated downward pivotal movement of the door 78a.

Referring to FIG. 12 and 13 there is shown a dunnage mechanism which is generally similar to that of the type illustrated in FIGS. 1 and 2, except that the mechanism for pulling the strip of crumpled sheetlike material through the crumpler comprises meshing gears 84, which in the embodiments illustrated are spur gears. These spur gears are rotatively mounted with respect to supporting means 86 and may be power driven as means of a preferably variable speed electric motor 88. The dunnage strip passes through the spur gears and is coined by the teeth of the gears, and the strip comes out as an elongated generally linear strip of material. Such dunnage material due in part to its corrugated configuration 90 (FIGS. 14 and 15) does possess considerable cushioning effect, and may be cut into suitable sections for providing dunnage for use in packing, and as shown for instance in FIG. 11. It will be understood, of course, that the dunnage strip can be fed in one continuous strip into a packing or shipping carton without cutting it into predetermined length sections.

The mechanism illustrated in FIG. 16 is similar to the dunnage of FIG. 14, except that the gears which coin the strip of sheetlike material and pull it through the crumpler are helical gears, thereby giving the strip 92 of dunnage a corrugated configuration at oblique angles with respect to the lengthwise axis of the strip. Here again such dunnage possesses considerable cushioning effect. However, it does not possess the cushioning effect possessed by the spirally formed dunnage produced by the FIGS. 5 and 7 mechanism.

Referring now to FIG. 17 there is shown another embodiment of a dunnage producing mechanism. In this embodiment the crumple mechanism takes the form of a framework 96 which has a plurality of converging slats 96a, 96b mounted to a fabricated support 98, with the slats being offset with respect to one another at their distal ends and in generally horizontal directions, and being generally aligned at their proximate ends 100, so as that the sheetlike material 114 coming from the vertically oriented rotatable roll 102 (FIG. 19) is pulled through the slat framework, the sheetlike material is automatically folded or creased into a generally flat elongated relatively narrow strip 104 of material, such as shown for instance in FIG. 20. In this connection it will be seen that the sheetlike material 114 coming from the roll 102 first passes around the exterior of generally vertical rib 106 and then passes behind generally vertically arcuate rib 108 prior to passing through vertical slot 110 (FIG. 17) in the support 98 and into coaction with converging slats 96a, 96b. Rib 108 tensions the web 14 of paper into a generally vertically concave configuration which aids in the folding thereof into strip form 104 by crumpler mechanism 96. A friction braking mechanism 112 anchored as at 112a and 112b maintains a tension on the material of roll 102 and prevents overrunning thereof.

The relatively narrow strip of sheetlike material 104 is then passed between a pair of coacting rollers 114, 114a which are geared together, as at 115, and with one (e.g. 114) of the rollers being power driven, so as to actually pull the strip through the crumpler or folding mechanism 96. The strip may then pass over a rotatable roller 116, and is fed onto the underside of a belt 118 which coacts with a spiral or helical mandrel 120, to draw the strip around helicalwise, and at right angles to the direction of travel, thus forming the linear strip 104 of material into a permanent helical or spiral form, which helical form, as shown in FIG. 21, has a considerable amount of resiliency both axially and transversely thereof.

The belt 118 winds around the helical mandrel 120, as at 124 (FIG. 17) and which is set at approximately a 45° angle in a horizontal plane, with respect to the axis of the roller 116, and then passes around a large crown-faced pulley or drum 126 which is power driven as by means of an electric motor 128 and coacting geared speed reduction unit 130. The belt 118 then extends forwardly to pass around crown-faced pulley 132 and then beneath the pulley 132 to coact with roller 116 in drawing the strip 104 of material coming from crumpler 96, around the spiral counterweight 110. Roller 116 and pulley 132 may be geared together as at 133.

A chain and sprocket drive mechanism 134 may be used to drive a pulley 136 which is connected as by means of a belt 138 to pulley 140 (FIG. 18) coupled to one (e.g. 114) of the drawing rollers which are geared together as aforementioned.

Coacting with the belt 118 there may be an idler arm and roller means 142 which places a predetermined tension on the belt to maintain the belt in tensioned relationship as it passes around the pulleys 126 and 132. As can be best seen in FIG. 22, the belt 118 is formed with a full 360° twist, for enabling the belt to coact with the spiral mandrel 120, in a manner to permit the belt to travel flat without twist as it moves from the top of 126 to top of 132. A preferably rotatable guide means 144 coacting with the outer edge of the belt 118 may also be provided for guiding the movement of the belt. The coiled dunnage as it exits from the outer end of mandrel 120 is rotating about its lengthwise axis, and curls about takeoff and guide rod 148 which is sloped downwardly to direct the endless coil of dunnage along the takeoff rod to a receptacle 150 or the like.

A cutter mechanism 152 may be provided, which in the embodiment illustrated comprises a shearslike means 154 through which the strip of coiled dunnage must pass, in order to coact with the takeoff rod 148. One of the blades of the
shear mechanism may be coupled to a fluid powered motor unit 156 which may be of the double-acting cylinder type, and which may be selectively controlled by an operator to cut the strip of dunnage as it is emanating from the mandrel 120 and coacting belt 118. Operation of the cutter mechanism will cut the coiled strip of dunnage into selected lengths for use as loose packing material. The operator may preset the machine to automatically cut off desired lengths. It will be understood that the distal end of the coiled dunnage coming off the takeoff rod 148 should be free, so as to prevent uncoiling forces from being applied thereto.

Referring now to FIGS. 23 and 24, there is shown another embodiment of dunnage-producing mechanism which is adapted in the embodiment illustrated, to utilize a plurality of webs of a sheetlike material and to combine and form such plurality of webs into an integral, resilient, tubularlike construction of cushioning dunnage. It will be understood that only one web of stock material could also be used to form a tubularlike dunnage product.

Such mechanism as illustrated may comprise a base support 160 having rack structure 162 mounted thereon, which rack structure is adapted to support a plurality of spaced rolls 164, 164a, 164b of the sheet or weblike material. As illustrated, the lower roll 164 is preferably of a lesser width material as compared to the upper roll 164a.

The rolls 164, 164a are rotatably mounted on rack structure 162, and suitable braking mechanism (not shown) is preferably provided coacting with the rolls to prevent overrunning of the latter. The web of sheet material from the selected length of the respective roll is adapted to be drawn downwardly into the crumper mechanism 169 where it is formed into a generally loose tubularlike configuration after which it is passed through gear means 170 which stitches or coils together as least the free lengthwise edges 171, 171a of the tubular-shaped sheet stock from emitting the crumper 169, to thus maintain the multiew dunnage product in integral assembled tubularlike configuration.

The crumper 169 in the embodiment illustrated comprises a funnellike upper portion 172 which gathers in the plurality of webs coming from the rolls 164, 164a, and a lower, sleeve portion 174 which forms such gathered webs of material into a generally tubular configuration, and guides the latter into the gear means 170. The sleeve portion 174 has cutaway portions 174a at its lower end so as to be drawn downwardly into the coating gear means 170 (FIG. 24) which are adapted to draw the multiewd web assembly down through the crumper, and to stitch the opposite sides thereof. As can be seen in FIG. 24, the gears are so positioned with respect to the sleeve portion 174 that they will engage just opposite edges of the multiew assembly as it passes from the sleeve portion into the teeth or bite of the gear means.

In the embodiment illustrated, two sets of coating spur gears 170 are illustrated, with one gear of each set being power driven as by means of the motor 178 and associated belt drive 180 cooperating with a pulley 182 fixed to a shaft 184 to which one (186) of the gears of each set of gear means 170 is keyed or otherwise secured. The gears of each set are preferably adjustable with respect to one another so as to provide for varying the mesh clearance.

Extending upwardly from the crumper 169 and more particularly the funnel portion 172 of the crumper 169, may be a bar support 188 to which is preferably adjustably secured as at 189, a gathering ring 190, oriented in overlying generally centered relationship to the funnel portion 172, for the purpose of gathering and guiding the webs from the face of the upper stock roll 164a and the lower stock roll 164, and guiding them into the funnel portion 172. The web from the lower roll 164 passes interiorly of ring 190 while the web from upper roll 164a passes exter- iorly of the ring. Extending upwardly from the distal side of the gathering ring 190 may be a belly pusher rod 192 (FIG. 24) which is adapted to engage the web at the face of the web of material from all of the upper stock roll 164a and guides the web into the funnel portion in the tubular forming operation. Rod 192 preferably has a rounded upper end 194 for preventing tearing of the web of stock material by the rod during engagement thereof with the web. As can be best seen in FIG. 24, the web of material from the upper stock roll is adapted to pass rearwardly of the rod 192 and down into the funnel to be formed into generally tubular condition, after which the opposite lengthwise edges of the formed sheet of material from both the upper and lower stock rolls are stitched by the gear means 170.

Disposed above the guide ring 190 may be a forming ring 198, also projecting outwardly from support 188 into overlying relationship with respect to the funnel portion 172, and as can be seen in FIG. 24 generally centered thereabove. Forming ring 198 is adapted to engage the front surface of the web of lower stock roll 164 and to aid in forming it into generally tubular shape for entry into the crumper. Extending downwardly through the crumper mechanism may be a guide rod 200 which likewise may be supported on support 188, and which passes down through the guide ring 190, through the crumper 169, to terminate approximately at the support 160. Such guide rods aids in guiding the plurality of webs from the upper and lower stock rolls into a tubularlike dunnage product, and in stabilizing and centering the tubular stock material as it passes through the gear means 170.

The tubular like dunnage product 203 emitting from between the gear means passes downwardly through an opening 202 (FIG. 23) in the support 160, and between a cutter mechanism 204 which may be selectively operated to cut the dunnage product into selected lengths.

Referring now to FIGS. 27 and 28 it will be seen that the dunnage product is of generally irregular tubular configuration comprising an outer layer or envelope 206 formed from the web of material from upper roll 164a, and generally loosely interleaved inner filler layers 208 formed primarily from the lower roll 164, all of which is stitched along opposing lengthwise sides 210 of the gear means 170.

Such a dunnage product has a low density and high resilience, and results in a dunnage product possessing good cushioning properties.

FIGS. 29 and 30 disclose a dunnage product 212 produced by a machine generally similar to that of FIGS. 23 and 24, except utilizing only one set of gear means so that the tubularlike dunnage is stitched or coined along only the open edges (as at 214) with the opposite side edges 216 not being coined. This product likewise comprises an outer envelope 216 and loosely interleaved inner layers 218, and giving good cushioning properties.

It has been found that the outer envelope of the tubularlike dunnage product may be expeditiously formed of a relatively high strength sheet material, such as for instance Kraft paper, while the inner filler layers provided by roll 164 may be formed of a cheaper and less high strength material, such as for instance newsprint paper. Also, a dunnage product formed from an outer envelope of a softer sheet material, such as for instance Kraft dry waxed paper, with the inner filler material formed from the stiffer standard Kraft thirty pound paper, has been found to provide an expeditious cushioning dunnage product having dust free and soft exterior characteristics, while still possessing internal stiffness for relatively high resiliency.

The aforementioned cutter mechanism 204 may comprise shear blades 220 including arm portions 221 (FIG. 31) which are pivoted to one another as at 222 and are pivotally mounted as at 223, to a respective gear 224, 226 disposed in meshing relation, and with a handle mechanism 228 (FIG. 24) being provided for rotating gear 224, thereby causing rotation of gear 226 and opening and closing movements of the shear blades. As can be seen from FIG. 31, upon rotation of the handle of the cutter mechanism to act to cause rotary movement of the meshed gears in the direction of the full line arrows, the pivotal axes 223 of the arm portions 221 of the cutter to the respective gear moves for instance from position 1 to position 2 wherein the blades 220 are spaced apart as illustrated by the
dashed lines, then to position 3 wherein the blades commence to close as shown by the dotted lines, then to position 4 wherein the blades are closed a greater amount as illustrated by the dot-dashed lines, with the blades being extended forwardly to their forwardmost position, than back to position 1 wherein the blades are retracted and close, to cause cutting of the crumpled material. Accordingly the dunnage is cut as the blades are being retracted, and severing of the tubular like dunnage product is accomplished without tearing thereof.

From the foregoing discussion and accompanying drawings it will be seen that the invention provides novel methods for producing dunnage which includes forming sheetlike material from a roll thereof into an elongated relatively narrow strip or rope, together with means for drawing the strip through a crumpler means and forming the strip or rope into helical coiled configuration, to give substantial resiliency to the dunnage, thus improving the cushioning characteristics thereof in its use as loose packing material. Moreover, the invention provides a method for forming a web of sheetlike material into a tubularlike form of highly resilient, low density dunnage. The invention also provides a novel method for producing a dunnage product which has increased resiliency over dunnage heretofore known, and which is formed from sheetlike material, such as ordinary Kraft paper, which may be stored in compact roll form prior to its formation into suitable dunnage and which may be fed directly from a dunnage producing mechanism. The invention also provides a novel method for producing dunnage, which greatly simplifies the production of dunnage, resulting in economies in such production.

The terms and expressions which have been used are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown or described, or portions thereof, and it is recognized that various modifications are possible within the scope of the terms and expressions utilized to define the invention.

What is claimed is:

1. A method in producing cushioning dunnage comprising, taking a web of sheetlike stock material such as paper, crumpling it down into a relatively narrow strip of material, and then forming said strip by pressure into elongated generally helically coiled form, and wherein said forming of said strip into generally helically coiled form is provided by coining the strip generally transversely thereof at lengthwise spaced locations therealong by directing the strip through coasting toothed faces of meshing bevel gears, while rotating the gears about axes disposed in a common plane to cause driving of the gears and drawing of the strip of material through the gears, said directing comprising feeding the strip obliquely toward said plane and between the faces of the meshing bevel gears.

2. A method in accordance with claim 1 including cutting said coiled strip into lengths.

3. In a method of producing cushioning dunnage comprising, taking a web of sheetlike material such as paper, crumpling it down into a relatively narrow strip of material, and then forming said strip by pressure into elongated generally helically coiled form, and including the step of periodically interrupting the formation of said strip into regular helically coiled form and producing spaced malformed noncoiled portions in the coiled strip along the lengthwise extent thereof.

4. In a method for producing lightweight, high-bulk cushioning dunnage comprising taking a web of flexible sheetlike stock material, such as paper, drawing the web lengthwise thereof while forming said web into generally tubular like shape, and including engaging the web of material from one side thereof by forming means to concave the sheetlike material in a direction transversely thereof and thus urge and guide the sheetlike material toward generally tubular like configuration, and generally radially loosely crumpling the formed material, and securing the crumpled tubular like article lengthwise thereof to maintain its configuration.

5. A method in accordance with claim 4 including utilizing a plurality of webs of sheetlike material and forming said plurality of webs into said generally tubular like shape with one web being generally interposed within the adjacent web, and then performing said securing of the article by stitching the tubular like article lengthwise thereof to form the material into an integral product.

6. A method in accordance with claim 4 wherein said web is formed into said generally tubular like configuration by moving the lengthwise edges of the web inwardly toward one another and loosely crumpling the web generally radially inwardly, and then performing said securing by stitching by pressure deformation of the tubular like article along the lengthwise extent of the juncture of said edges to maintain the product in said generally tubular like configuration.

7. A method in accordance with claim 4 including utilizing a plurality of webs of sheetlike material and forming said webs into integral generally tubular like shape with one web generally interposed within the adjacent web, and then performing said securing by stitching the tubular like article along the lengthwise extent thereof to maintain the webs as an integral product.

8. A method in accordance with claim 1 wherein the sheetlike stock material is maintained in compact dense condition, such as in roll form prior to formation into said dunnage, and pulling the web of stock material from said roll.

9. A method in accordance with claim 4 wherein the sheetlike stock material is maintained in compact dense condition, such as in roll form prior to formation into said dunnage, and pulling the web of stock material from said roll.

10. A method in accordance with claim 1 including the step of utilizing said method at the point of packing operations for efficient transmittal of resilient dunnage product directly into containers being packed.

11. A method in accordance with claim 4 including the step of utilizing said method at the point of packing operations for efficient transmittal of resilient dunnage product directly into containers being packed.

12. In a method of producing cushioning dunnage comprising, taking a web of sheetlike material and wherein such as paper, crumpling it down into a relatively narrow strip of material, forming said strip by pressure into elongated generally helically coiled form, and wherein said crumpling includes folding the material into a generally flattened relatively narrow strip form, moving the flattened strip between roller means to compress the same, then pressing the strip around a helical mandrel while engaging the strip from the other side thereof and around said mandrel to compress the strip into helical coil like form.

13. In a method of producing cushioning dunnage comprising taking a web of sheetlike material, such as paper, crumpling the web of material down into an elongated relatively narrow strip by drawing the material through a funnel-like member, and forming said strip by pressure into elongated generally helically coiled form by coining the strip generally transversely thereof at lengthwise spaced location therealong by directing the strip through coasting toothed faces of meshing driven bevel gears and at an angle, the axis of which extends obliquely toward a plane containing the axes of rotation of said gears whereby the coiled strip rotates about its lengthwise axis as it is emitted from between said gears, and periodically engaging the distal end of the strip of material downstream from said gears by frictional engagement with an abutment means for preventing formation of said strip into regular helical coiled form but instead causing the strip to periodically kink and interrupt the regular helical coil configuration thereof as produced by the gears, due to the holding frictional coaction of the rotating coiled strip with said abutment means, whereby spaced malformed noncoiled portions are formed in the coil strip along the lengthwise extent thereof.

14. A method in accordance with claim 4 including mounting a roll of sheetlike material for rotation about its lengthwise axis, drawing the material from the roll to accom-
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plish said forming and said crumpling, and said securing comprising stitching by pressure deformation of the tubular like article along the lengthwise extent of the juncture of the edges

of said formed web to maintain the product in generally tubular like configuration.