

[54] CUSHIONING DUNNAGE MECHANISM AND METHOD

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3,509,797 5/1970 Johnson..... 93/1 WZ

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[22] Filed: **Dec. 14, 1971**

[21] Appl. No.: **207,764**

[52] U.S. Cl..... **93/1 WZ, 93/1.1, 93/84 R, 156/493, 156/510**

[51] Int. Cl..... **B31d 5/00, B31f 1/08**

[58] Field of Search ..... 156/152, 183, 201, 204, 156/268, 391, 438, 461, 463, 467, 558, 559, 156/493; 93/1 F, 1 WZ, 84 R, 1 C

[56] **References Cited**

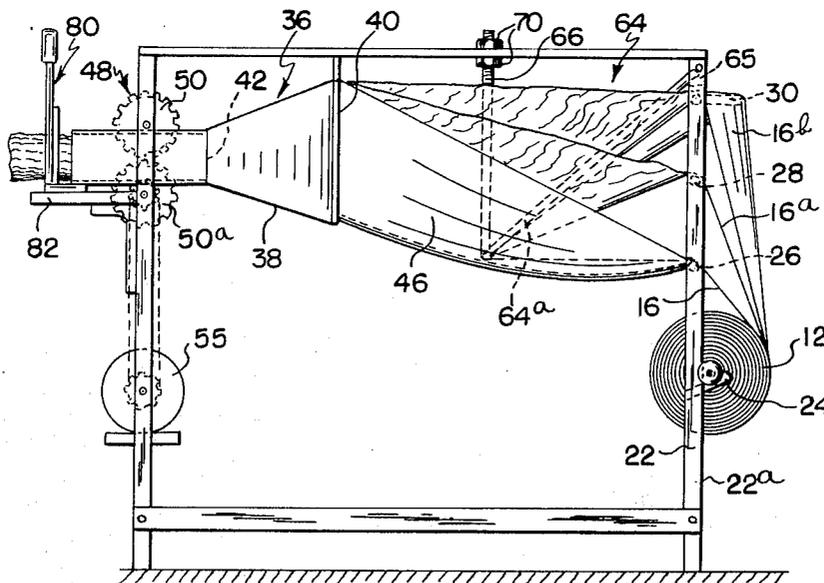
**UNITED STATES PATENTS**

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[57] **ABSTRACT**

A cushioning dunnage producing mechanism which is of compact nature utilizing a single roll of stock material comprising multiple plies of sheet-like material, such as paper stock, which are separated as they are pulled off the composite roll, rolled or urged inwardly at their lateral edges and into generally superimposed condition and passed into a crumpler section where meshed gears coin or stitch the confronting portions of the rolled edges of the stock material together generally centrally in a direction lengthwise thereof, to hold the dunnage product in a light weight, highly compressible, pad-like configuration. A novel method of producing the pad-like product is also disclosed.

**15 Claims, 7 Drawing Figures**



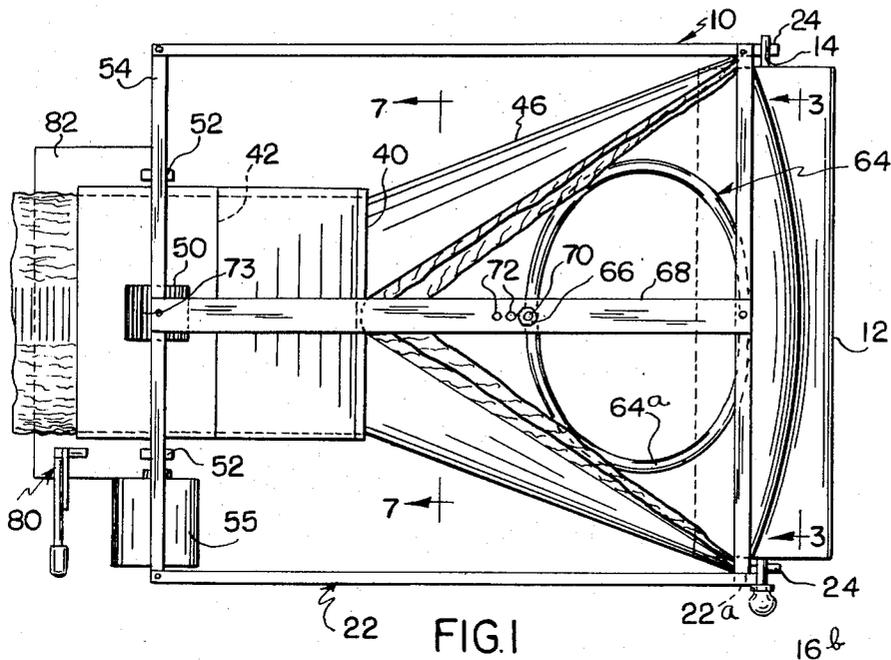


FIG. 1

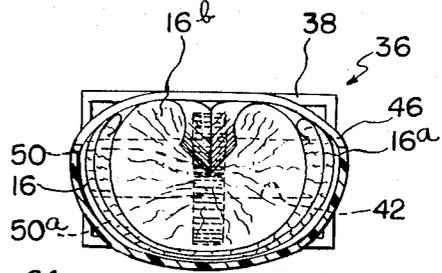


FIG. 7

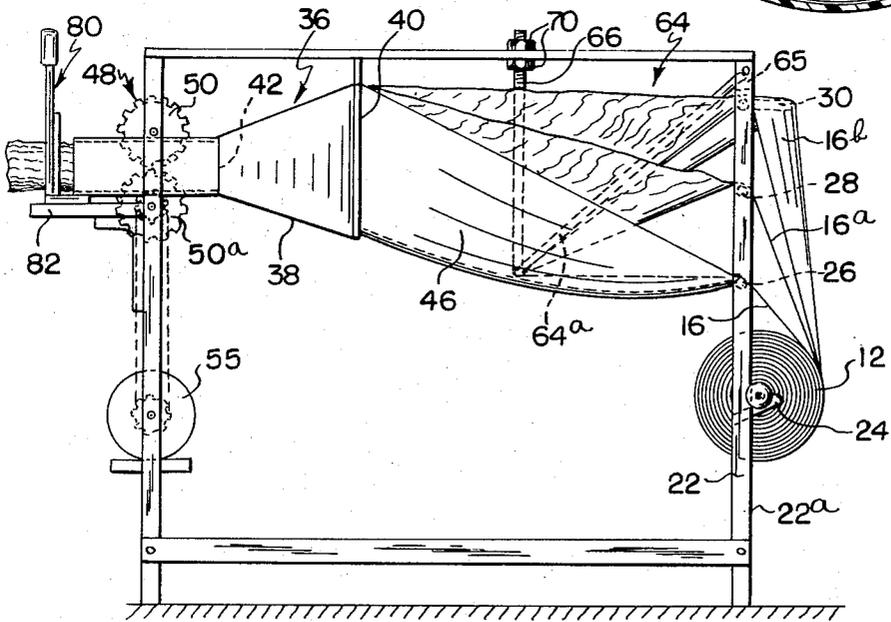


FIG. 2

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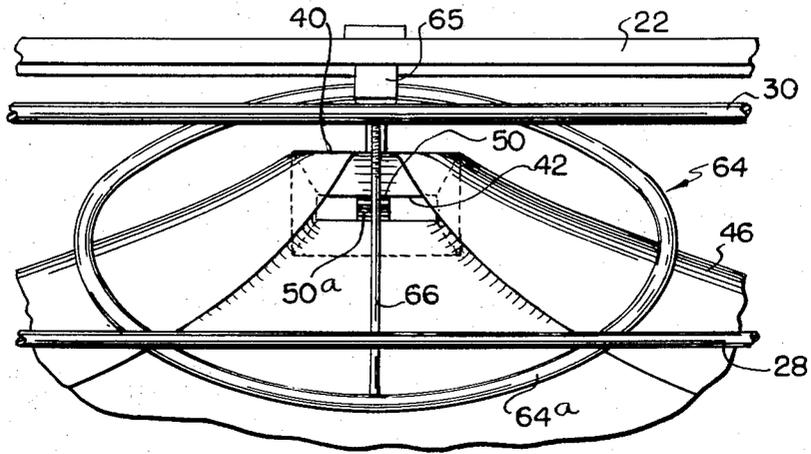


FIG. 3

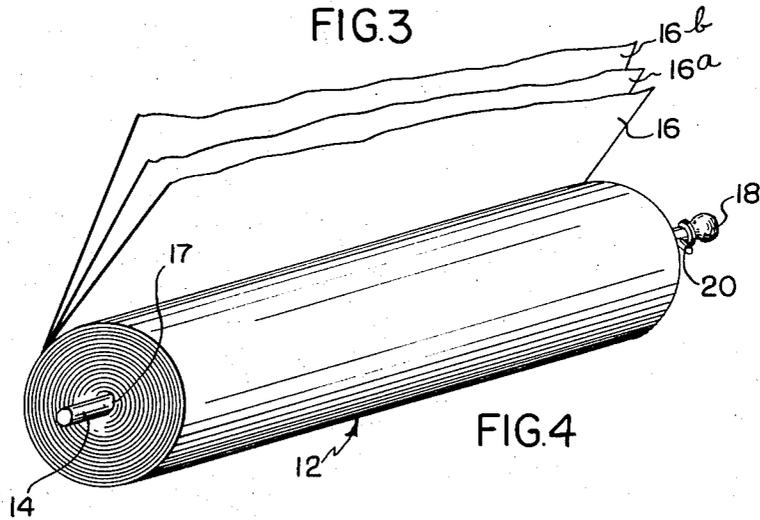


FIG. 4

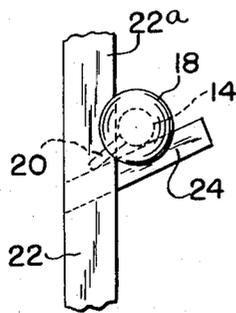


FIG. 5

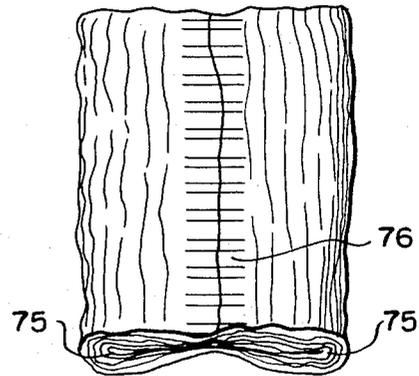


FIG. 6

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## CUSHIONING DUNNAGE MECHANISM AND METHOD

This invention relates in general to a mechanism for producing packing material or cushioning dunnage as it is known in the art, and more particularly to a dunnage producing mechanism for expeditiously producing a continuous, highly resilient, pad-like dunnage product from sheet-like material, such as paper disposed in a single, composite, multi-ply stock roll. The invention also relates to a novel method for producing the pad-like cushioning dunnage product.

### BACKGROUND OF THE INVENTION

In U.S. Pat. No. 3,509,798 issued May 5, 1970 to George R. Johnson and entitled Mechanism and Method for Producing Cushioning Dunnage, there is disclosed a mechanism for producing cushioning dunnage which is of the general type produced on the mechanism of the present invention. However, such prior art machine necessitates considerable floor space, and when a plurality of rolls of sheet-like stock material are utilized for the stock supply to form pad-like cushioning product, the amount of work and time involved in supplying the mechanism with stock material and in replenishing the stock material as it is utilized is considerable. Also, it is generally necessary to maintain a supply of various widths of relatively heavy rolls of stock material for use in the mechanism, and in general the problems associated with maintaining and handling the supply of the stock rolls for use in producing the cushioning dunnage product are multiplied. Moreover, due to the size and weight of the individual rolls of stock material, considerable tension on the individual webs coming off the individual rolls occurs, increasing the probability of tearing of the webs of stock as they are pulled into the mechanism.

### SUMMARY OF THE INVENTION

The present invention provides a novel mechanism for expeditiously producing from sheet-like material, such as paper, a pad-like cushioning dunnage product having good resiliency and cushioning characteristics, and which dunnage product is of low density per unit volume, and wherein the mechanism is of a compact nature for utilizing minimum floor space. The invention also provides for a novel method for producing the packing material, and enables the conversion of multi-ply paper stock disposed in a single composite stock roll, to be changed from a density of, for instance, 40 to 50 pounds per cubic foot requiring relatively little storage space, into cushioning dunnage having a density of, for instance, one to two pounds per cubic foot, and as needed for easy and rapid direct placement into a package at a packaging station.

Accordingly, an object of the invention is to provide a novel compact mechanism for producing dunnage or packing material.

Another object of the invention is to provide a mechanism of the latter type which utilizes a single stock roll of sheet-like material having multiple sheets wound thereon, and wherein such multiple sheets are taken from the stock roll and separated and then generally superimposed upon one another to produce the resilient cushioning dunnage product.

A still further object of the invention is to provide a mechanism of the character described in which the lat-

eral edge portions of the webs of sheet-like material are urged into generally inwardly turned or rolled form in transverse cross section, and then the sheet-like material is drawn through a crumpler section of the dunnage mechanism by means of meshed gears which grip the crumpled rolled edge portions of the sheets generally centrally of the product and stitch or coin the rolled and inwardly crumpled edge portions together lengthwise of the sheets, to provide a unitary pad-like cushioning dunnage product of considerable resilience and compressibility, especially at its lateral portions.

A still further object of the invention is to provide a novel method for producing the dunnage product, the latter being generally of pad-like configuration, and comprising the drawing of plies or sheets of the sheet-like stock material from a single composite stock roll, and forming and crumpling the sheets into the pad-like product, which possesses high compressibility and low density characteristics.

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

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan, somewhat diagrammatic illustration of a mechanism embodying the present invention;

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

FIG. 3 is a fragmentary, elevational view taken generally along the plane of line 3—3 of FIG. 1 looking in the direction of the arrows, with the sheet stock material having been deleted;

FIG. 4 is a perspective illustration of one of the multi-ply stock rolls of sheet-like material, adapted for utilization with the dunnage producing mechanism of the invention, and wherein the stock roll comprises a plurality of superimposed equal width sheets of the stock material;

FIG. 5 is an enlarged, fragmentary, end elevational view of the arrangement for supporting the stock roll on the frame of the dunnage producing mechanism, together with the means for limiting the rotation of the roll shaft with respect to the supporting frame;

FIG. 6 is a fragmentary, perspective illustration of a piece of the cushioning dunnage product of the invention, and particularly showing the coining or stitching of the pad-like article lengthwise and generally centrally thereof; and

FIG. 7 is a sectional view taken generally along the plane of line 7—7 of FIG. 1 looking in the direction of the arrows.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now again to the drawings, there is illustrated a dunnage producing mechanism 10 which utilizes a single multi-ply stock roll 12 of sheet-like material, such as Kraft paper. The roll 12 comprises a supporting rod or shaft 14 preferably of cylindrical configuration, on which three superimposed webs or runs 16, 16a, and 16b of rolled paper stock are mounted, with the paper being adapted to roll or rotate relative to the rod 14. In other words, a certain amount of space or looseness is provided as at 17 (FIG. 4) between the rolled sheet stock and the rod 14. In this connection, one end of the rod is plain (the left-hand end, as shown

in FIG. 4) while the other end (the right-hand end, as shown in FIG. 4) has an enlarged knob portion 18 thereon, and with a pin 20 preferably extending from the knob end of rod 14, generally perpendicular with respect thereto, for a purpose to be hereinafter described. The roll of stock material may be, for instance, of a dimension of 9½ to 10 inches in diameter by 30 inches in width, with all of the plys or sheets 16, 16a and 16b preferably being of the same width.

The stock roll 12 is mounted on a rigid frame 22, and as by means of brackets 24 which project angularly outwardly from the uprights 22a of frame 22. It can be seen that with the rod 14 projecting outwardly of the ends of the stock roll 12, that such projecting rod ends can be readily supported on brackets 24 of frame 22, and will rest thereon for mounting and maintaining the stock roll in position on the frame 22. The aforementioned pin 20 on the rod 14 is adapted to engage the associated bracket 24 and prevent rotation of the rod during removal of the paper stock material from the roll. As aforementioned, the roll of paper stock material rotates relative to the supporting rod 14 of the roll, which rod 14 is prevented from rotating by the pin 20 engaging associated bracket 24. Lengthwise movement of the rod with respect to the frame is limited by the aforementioned knob 18 disposed on one side of associated upright frame 22, and the aforementioned pin 20 disposed on the opposite or inner side of the associated upright of frame 22.

Mounted on frame 22 in vertically spaced generally evenly spaced relation relative to one another are cross rods 26, 28 and 30 (FIG. 2). Each of the rods is adapted to coact in engaged relation with an associated one of the sheets or runs 16, 16a and 16b of the stock roll, with, for instance, sheet or run 16 of the stock material being adapted to pass over rod 26, run 16a being adapted to pass over rod 28 and run 16b from the stock roll being adapted to pass about upper rod 30. As can be best seen from FIG. 2, the sheets or runs of stock material from the composite roll 12 are separated as the stock material is withdrawn from the roll during frictional rotation of the latter on rod 14.

The upper guide rod 30 is preferably of arcuate configuration in a rearward direction, so that its convex side projects rearwardly, as best shown in FIGS. 1 and 2, which arcuate guide rod aids in "bellying" the associated run 16b of stock material prior to its being rolled or turned inwardly at its lateral edges and fed into the crumpling section 36 of the dunnage producing mechanism. Also, the tension is applied more to the central portion of the sheet 16b which aids in preventing tearing of the sheet along the edges thereof.

Crumpler section 36 comprises a funnel-like portion 38 which opens in the direction of the location of the stock roll 12, and a finishing portion 38a communicating with the funnel-like portion 38 and extending forwardly therefrom. Funnel-like portion 38 includes a widened mouth 40 (FIG. 2) which slopes or converges inwardly to a narrowed throat 42 (FIG. 3) so that the sheet stock material is compressed radially inwardly or crumpled vertically inwardly into a generally irregular, random-like, loosely crumpled pattern, resulting in a generally rectangular-shaped pad-like configuration as it passes through the throat portion 42 into the finishing portion 38a.

Extending from the funnel-like portion 38 of the crumpler section to the vicinity of the lower guide rod

26 on the frame 22, is a forwardly converging (as viewed in FIG. 1) trough 46 which may be formed of any suitable material but which may be conveniently formed of plastic, which trough forms a guide for the runs of stock material 16, 16a and 16b as they are drawn off of the stock roll 12 and passed to the crumpler section 36 of the dunnage producing mechanism.

Finishing section 38a of the crumpler section preferably has rectangular slots in its upper and lower walls and into which extend the connecting or stitcher means 48, for connecting confronting portions of the loosely crumpled stock material together, as the latter is drawn through the crumpler section by means 48. In the embodiment illustrated, the stitcher or connecting means 48 comprises generally loosely meshed equal size spur gears 50, 50a, which are rotatably mounted in bearing structure 52 (FIG. 1) secured to the supporting portion 54 of the frame 22 of the dunnage producing mechanism. Gears 50, 50a may be driven by any suitable means, such as, for instance, an electric motor and associated speed reduction unit 55, and in a manner which may be generally similar to the arrangement illustrated in aforementioned U.S. Pat. No. 3,509,798. Such gears may be adjustably mounted with respect to one another for selectively varying the amount of spacing or meshing between the gears and in a similar manner as described in aforementioned U.S. Pat. No. 3,509,798.

The lateral edges of the webs 16, 16a and 16b of the stock roll after they pass the spaced transversely extending guide rods 26, 28 and 30, are commenced to be rolled or turned inwardly into generally spiral-like orientation, with such inwardly rolled edges being disposed in loose, relative to one another, condition as they move into the mouth 40 of the crumpler section 36 of the machine. It will be seen that the aforementioned arcuate rod 30 materially aids in forming the aforementioned beveled or "bellied" condition of the inner web 16b of the stock roll. In this connection there is provided a pusher or "bellying" mechanism 64 (FIGS. 1, 2 and 3) on the machine which, in the embodiment illustrated, includes a generally circular hoop 64a and which may be formed of, for instance, smooth tubing. The hoop 64a is obliquely oriented with respect to the machine, and is preferably pivotally mounted on frame section 22 as at 65, for adjusting movement in a generally vertical direction.

The lower end of the hoop 64a is preferably coupled, as by means of a generally upright rod 66, to cross member 68 of frame 22, and as by means of threaded fasteners 70. The connection between rod 66 and hoop 64a is preferably a movable connection, so that the rod position can be adjusted and thus the position of the hoop member 64a can likewise be conveniently adjusted with respect to the trough 46 and the webs 16, 16a and 16b of the stock roll. In this connection the cross member 68 may be provided with a number of openings 72 therein for selectively receiving the rod 66, during any adjustment of hoop member 64a. The hoop member where it engages the underlying web 16b of the stock material is smooth so that there is no danger of ripping or tearing of the paper web 16b by hoop 64a during the web's sliding generally tensional movement relative to the pusher mechanism 64. The hoop member slidably engaging the inner web 16b of stock material as the latter is pulled off the stock roll and moved

into the crumpler section 36 by the stitching gears 50, 50a, causes the lateral edges of the webs of stock material to roll or turn inwardly to form the webs into a forwardly converging trough-like configuration as the stock material moves into the mouth 40 of the crumpler section 36, thus aiding the trough 46 in forming the web stock material into generally loosely rolled resilient condition prior to movement of the stock into mouth 40 of crumpler section 36. It will be seen that the webs of stock after they pass about their respective guide rod are formed into a bellied configuration as the webs of stock material pass in generally tensioned condition beneath the pusher mechanism 64 whereby the lateral edge portions of the webs are urged into the rolled or inwardly turned configuration, which provides for the loose orientation and random crumpling of the web stock material as it passes through the funnel portion 38 and into the mouth 42 and finishing portion 38a of the crumpler section 36 where substantial vertical crumpling occurs. As can be seen, for instance, in FIGS. 1, 2 and 3, the arcuate pusher 64 conforms generally to the curvature of the trough interior. The aforementioned upper guide rod 30 preferably has a radius of curvature, the center of which is generally disposed along a vertical line passing through the center of the axes of the gears 50, 50a of the stitching section 48, and as at 73 (FIG. 1).

As can be seen from FIG. 6, the lateral portions 75 of the dunnage product are generally of randomly crumpled, pillow-like configuration having considerable resiliency due to the loose random crumpling of the inwardly turned edges of the superimposed web stock material, while the central section 76 of the product is compressedly stitched or coined together into fastened or held relationship, thus holding the low density dunnage product in generally pad-like form. A piece of the dunnage product produced by the mechanism from the aforementioned 30-inch width roll and with the piece of dunnage being approximately 9½ to 10 feet long may weigh about 1 pound, and provides about one cubic foot of cushioning dunnage, with the latter thus having a density of about 1 pound per cubic foot. Other widths or densities can, of course, be produced by varying the size of the crumpler section and varying the width of the webs of superimposed stock material on the roll. Also varying the weight and type of paper stock will, of course, vary the density of the finalized dunnage pad.

As the crumpled, web-like material passes into the stitching or connecting mechanism 48, the confronting sections of the rolled or inwardly turned edges of the web stock material which have been compressed and urged together due to the funnel portion 38 and the finishing portion 38a of the crumpler section 36 are stitched together, due to the coining action of the meshing gears, and generally centrally of the dunnage pad as at 76 (FIG. 6) to hold the crumpled lateral portions 75 of the sheet-like material together in a unitary pad-like configuration, having extremely good resilient characteristics and being of low weight per unit volume. After passing the stitching mechanism 48 which draws the stock material through the machine, the stitching mechanism pushes or urges the pad toward the distal end of the finishing portion 38a, to complete formation of the product into its generally pad-like configuration.

A cutter mechanism 80 of any suitable type may be provided on support 82 at the exit end of the finishing portion 38a, for selectively cutting the produced run of dunnage pad into desired lengths. In operation, the motor 55 which operates the stitcher mechanism which in turn moves the stock material through the machine, would preferably be provided with a conventional foot switch wherein the operator could selectively control the emission of length of pad-like dunnage from the machine, and by means of cutter mechanism 80 could selectively cut the formed dunnage pad to the desired lengths wanted. Cutter mechanism 80 may be manually powered or could be air cylinder powered if so desired.

From the foregoing discussion and accompanying drawings it will be seen that the invention provides a novel cushioning dunnage producing machine wherein the machine is of compact nature providing for its use in limited space environments, and wherein a single roll of stock material formed of a plurality of plies or webs of stock is utilized for forming the highly resilient, low density dunnage product, with the stock material being pulled off the roll and separated into individual webs and then redispersed in generally superimposed form, so that the edges of the webs are rolled or turned inwardly prior to their being randomly crumpled together by the crumpler section. The invention also provides a dunnage producing machine which simplifies the maintenance of the stock roll for the machine, and enables one size of stock roll to be used on the machine in the production of the dunnage product.

The invention also provides a novel method of producing a pad-like dunnage product and one which involves initially removing or pulling from a composite roll of multi-ply stock material the webs, and separating the webs into individual webs, and then re-imposing the webs together whereby the lateral edges of the webs are disposed in generally rolled or inwardly turned form prior to passing the stock material into a crumpler section, for crumpling the stock material into a low density, resilient pad-like configuration.

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 invention claimed.

What is claimed is:

1. In a mechanism for producing low density pad-like cushioning dunnage from sheet-like stock material comprising, crumpler means having an entry opening adapted to receive the sheet-like stock material therein, means disposed upstream of said crumpler means for rotatably mounting a single roll of the sheet-like stock material, said roll comprising a plurality of superimposed substantially equal width sheets of the stock material, means spaced from said roll for separating the sheets as they move from said roll towards said crumpler means, and means for causing inward orientation of the lateral edges of the sheet-like stock material into generally rolled form prior to entry of the sheet-like stock material into said crumpler means, said means for causing the inward orientation including trough means extending from said crumpler means to said separating means, and arcuate pusher means directed generally laterally toward said trough means and

positioned within said trough means, the trough means interior comprising a generally arcuate configuration in transverse cross section, said pusher means being upstream from said crumpler means and downstream from said separating means, and receiving the movable sheets of stock material between the underside of the pusher means and the confronting interior surface of the said trough means, said pusher means conforming generally to the curvature of the trough means interior, and connecting means for joining adjacent inwardly rolled edges of the sheet-like material as it passes through said crumpler means.

2. A mechanism in accordance with claim 1 including a frame mounting said separating means, said separating means comprising a plurality of vertically spaced, relative to one another, bars extending transversely of said frame, the axis of rotation of said roll being disposed upstream of said separating means.

3. In a mechanism for producing low density pad-like cushioning dunnage from sheet-like stock material comprising, crumpler means having an entry opening adapted to receive the sheet-like stock material therein, means disposed upstream of said crumpler means for rotatably mounting a single roll of the sheet-like material, said roll comprising a plurality of superimposed substantially equal width sheets of the stock material, means spaced vertically from said roll for separating the sheets as they move from said roll toward said crumpler means, and means for causing inward orientation of the lateral edges of the sheet-like stock material into generally rolled form prior to entry of the sheet-like stock material into said crumpler means, said means for causing inward orientation including a trough means extending from said crumpler means to said separating means, and arcuate pusher means directed generally laterally toward said trough means and positioned within said trough means, the trough means interior comprising a generally arcuate configuration in transverse cross section, said pusher means being upstream from said crumpler means and downstream from said separating means, and receiving the movable sheets of stock material between the underside of said pusher means and the generally closely spaced confronting interior surface of said trough means, said pusher means conforming generally to the curvature of said trough means interior, and connecting means on said crumpler means for joining adjacent inwardly rolled edges of the sheet-like material as it passes through said crumpler means.

4. A mechanism in accordance with claim 3 wherein said crumpler means comprises a funnel-like receiving portion defining said entry opening and a distal end finishing portion for further compressing the stock material into the pad-like configuration.

5. A mechanism in accordance with claim 3 wherein the axis of rotation of said roll mounting means is disposed below the elevation of said trough means.

6. A mechanism in accordance with claim 3 wherein said means for separating the sheets of stock material comprises a plurality of generally vertically spaced, with respect to one another, horizontally oriented bars about which a respective sheet of the stock material from said roll is adapted to pass during movement of the stock material from said roll to beneath said pusher means and toward said crumpler means.

7. A mechanism in accordance with claim 6 wherein said connecting means comprises vertically spaced ro-

tatable meshed gears disposed generally centrally of said crumpler means in a direction transverse of the latter, and adapted to compressively stitch the confronting edges of the sheet-like material together as the latter passes through said crumpler means.

8. A mechanism in accordance with claim 7 including power means operatively coupled to said connecting means for driving said connecting means whereby said connecting means is operative to pull the sheet-like stock material from said roll into said crumpler means.

9. A mechanism in accordance with claim 6 wherein said pusher means comprises a hoop disposed obliquely with respect to the vertical and extending in a plane generally transverse of said trough means, means for adjusting the position of the hoop with respect to the interior surface of said trough means, said roll of stock material being rotatably mounted below said trough means, said trough means extending from the lowermost of said bars to said entry opening of said crumpler means and merging with the latter.

10. A mechanism in accordance with claim 6 wherein the uppermost of said bars is outwardly convex in a generally horizontal plane for facilitating the rolling of the edges of the respective sheet material by said pusher means.

11. A mechanism in accordance with claim 10 wherein the radius of curvature of said uppermost bar commences substantially at a vertical axis passing through said connecting means.

12. A mechanism in accordance with claim 3 wherein said means for rotatably mounting said roll includes an upright frame and a shaft removably supported on said frame and on which said roll is rotatably mounted, and means for restricting rotation of said shaft with respect to said frame during rotation of said roll on said shaft, the last mentioned means including an abutment secured to said shaft laterally of said roll and projecting outwardly of said shaft, said frame having bracket means thereon, said abutment being adapted to engage said bracket means and prevent rotation of said shaft during rotation of said roll relative to said shaft during movement of the stock material from said roll toward said crumpler means.

13. A mechanism in accordance with claim 3 including cutter means downstream from said crumpler means for cutting the dunnage product into selected lengths.

14. A mechanism in accordance with claim 3 wherein said means for rotatably mounting said roll of stock material comprises an upright frame and a roll supporting bar removably mounted on said frame, said bar having an enlargement on one end thereof and means on the bar for preventing rotation thereof so that the roll of stock material must rotate relative to the bar during removal of the sheet-like stock material from the roll, said enlargement and the last mentioned means cooperating with said frame to limit axial movement of said bar and rotatably supported roll relative to said frame while permitting ready removal of said bar from said frame to provide for convenient replacement of said roll of stock material.

15. A mechanism in accordance with claim 3 including a frame supporting said roll for supporting the roll of stock material in predetermined position with respect to said crumpler means, said frame also mounting said separating means, said separating means compris-

ing a plurality of vertically spaced, relative to one another, bars extending transversely of said frame, said roll being rotatably mounted on said frame below the lowermost of said bars, said trough means being disposed at a level above the level of the rotatable mounting of said roll to said frame, said trough means com-

mencing substantially at said lowermost of said bars and sloping generally upwardly in a lengthwise direction to merge with said entry opening of said crumpler means.

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