

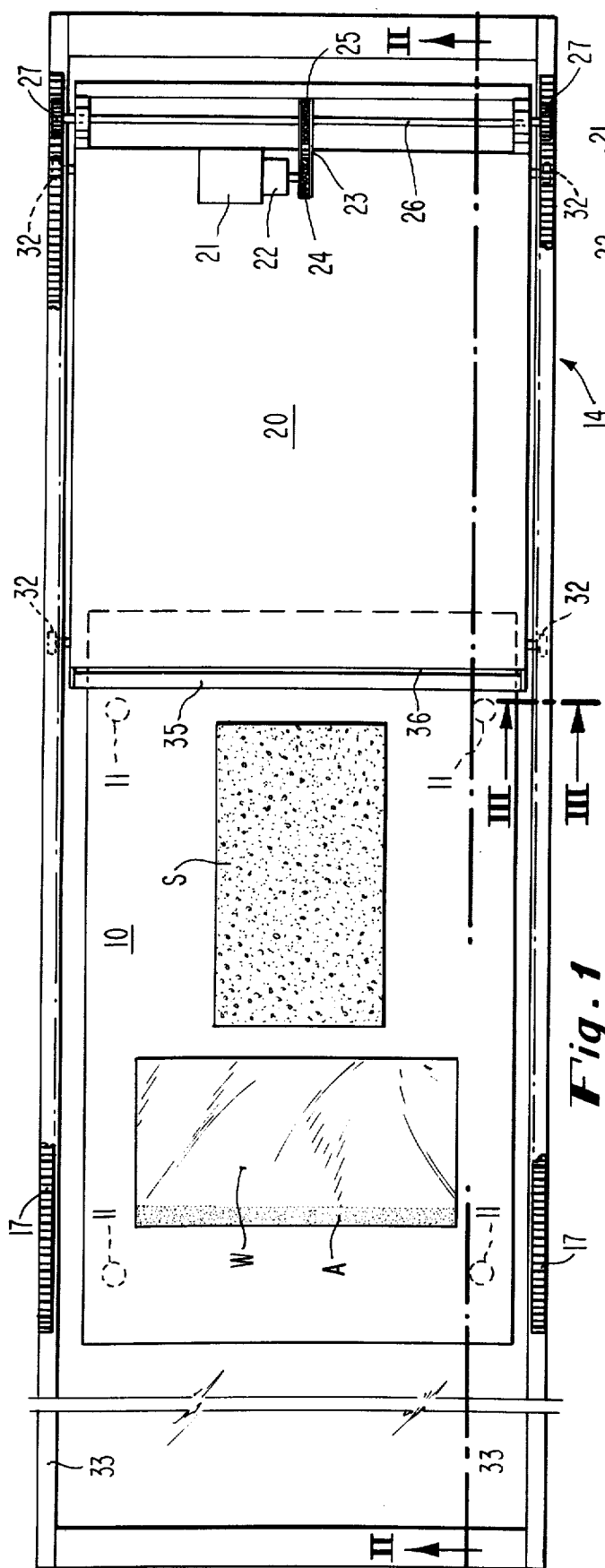


Fig. 1

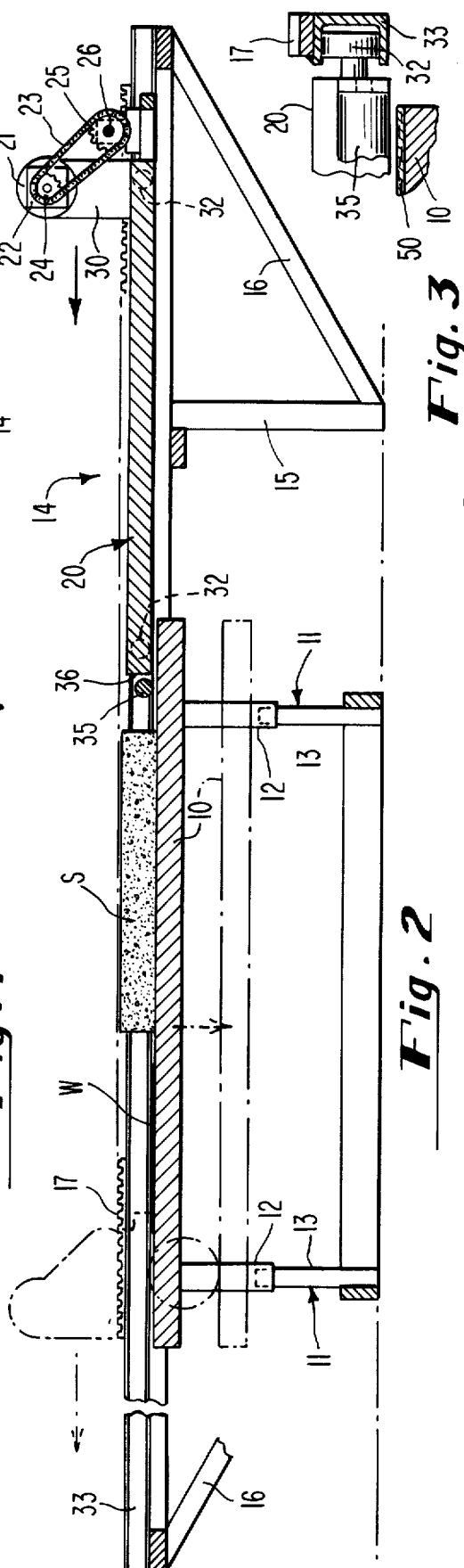
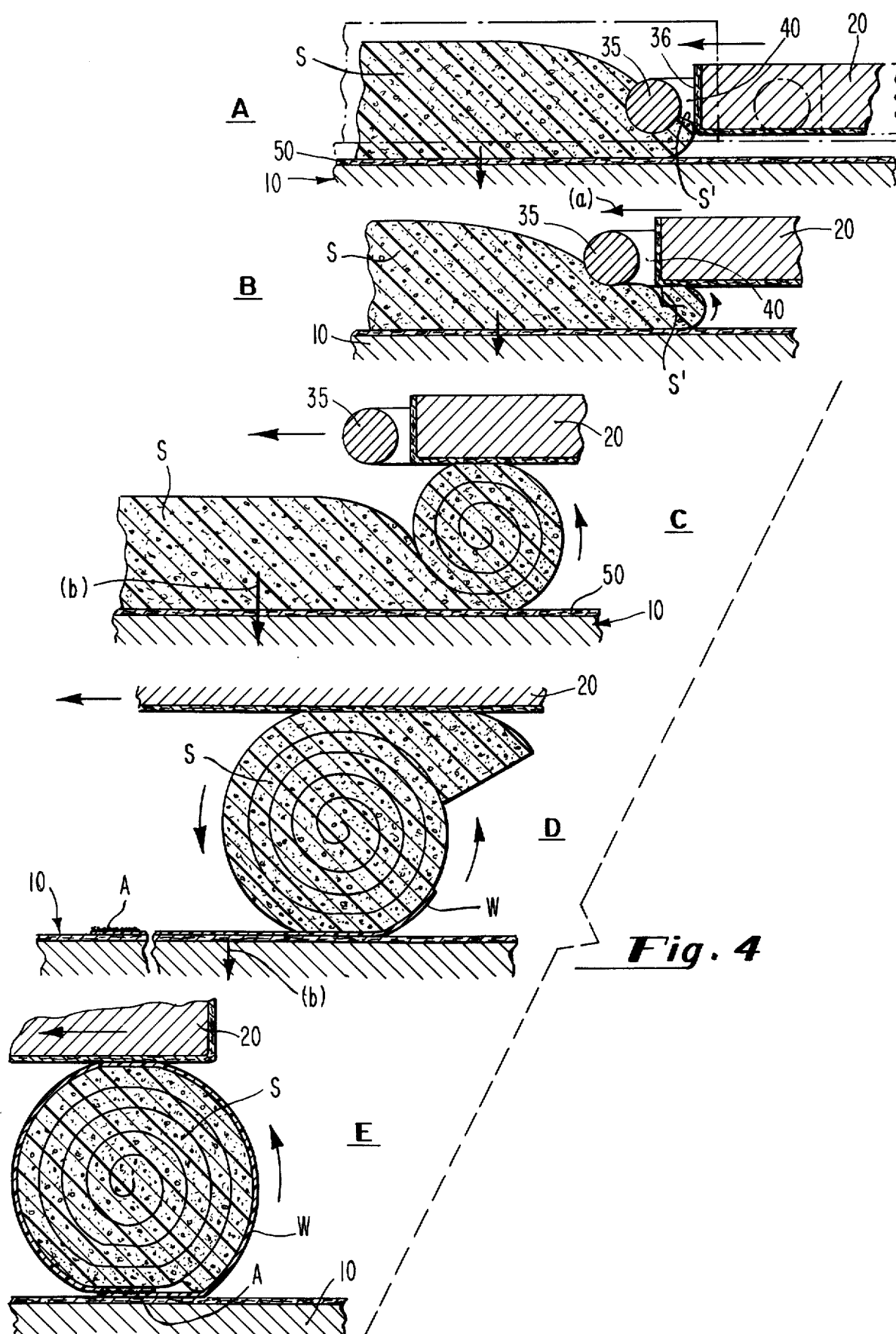


Fig. 2

Fig. 3



APPARATUS AND METHOD FOR PRODUCING A COMPRESSED, ROLLED PACKAGE OF RESILIENT MATERIAL

BRIEF DESCRIPTION OF THE INVENTION

This invention relates to an apparatus and method for producing a compressed, rolled package of resilient foamed sheet material, capable of mass production of such rolled packages, one after the other. In a preferred embodiment of the invention the foamed sheet material is pinched and roller directly upon itself, to produce an extremely tightly wound and very compact product. Desirably the product is rolled together with a wrapper sheet which may be provided with an adhesive surface whereby the wrapper sheet adheres to the foamed sheet material package, and to itself.

DISCUSSION OF THE PRIOR ART

It is known to provide a wrapping machine for carpets and the like, utilizing a mandrel and a rolling machine for rolling a length of carpet into a rolled package. It is also known in the art to provide a means for applying paper bands or the like to package the carpet roll after it has been formed. It is also known to provide a means for wrapping the rolled carpet with paper, in which the paper is applied not only to the curved cylindrical portion of the carpet, but to the ends of the carpet as well. Automatic machines have also been provided for taping or otherwise securing the rolled carpet in its position for storage and shipment.

However, no particular attention has been paid in the carpet industry to compression rolling of carpet, in a manner to produce a package that is smaller than the space normally occupied by the carpet itself. In this sense, the carpet has been treated as a relatively incompressible material, and no efforts have been made to both compress the carpet and wrap it into a very small, highly compressed package, so far as I am aware.

In the shipment of material containing large volumes of air space, such as foamed rubber or foamed polyurethane, for example, various efforts have indeed been made to form the material into a small package, thus saving space in shipment and storage. Endeavors have been made to ship foam rubber in vacuum packages for example, but all of these have involved the use of highly complicated, expensive and in some cases quite unreliable apparatus and methods.

OBJECTS OF THE INVENTION

It is accordingly an object of this invention to provide an apparatus and method for quickly, conveniently and economically wrapping a foam rubber sheet, containing a very substantial volume of voids, tightly and compressively into a rolled package which is readily stored and conveniently and economically shipped.

Other objects and advantages of this invention, including the simplicity and the economy of the same and the ease with which it may be applied for the handling of wide varieties of sizes and shapes of foamed sheet materials, will further become apparent hereinafter and in the drawings.

DRAWINGS

Of the drawings FIG. 1 is a plan view of a preferred embodiment of compressive rolling apparatus in accordance with this invention.

FIG. 2 is a view in side elevation of the apparatus illustrated in FIG. 1.

FIG. 3 is a somewhat enlarged, detailed view of a portion of the apparatus, taken as indicated by the lines and arrows III—III which appear in FIG. 1.

FIG. 4A shows the carrier and its roller contacting the leading edge of the foam sheet and beginning to curl it, FIG. 4B shows a further development in the curling procedure, FIG. 4C shows a still further development wherein the foam sheet is being tightly rolled upon itself, and FIGS. 4D and 4E show still further steps in the sequence of the method according to this invention.

DETAILED DESCRIPTION OF THE INVENTION

Although this invention will be described in this specification in specific terms, it should be understood that these terms are intended to describe only those particular forms of the invention that have been selected for illustration in the drawings, and are not intended to limit the scope of the invention, which is defined in the appended claims.

Turning now to the drawings, and referring particularly to FIGS. 1 and 2, the number 10 designates a table forming a support for a sheet of resilient foam material S, and also, spaced from the sheet S, a sheet of wrapper material W may be provided desirably with a strip of self-adhesive A. As shown, the foam is spaced slightly apart from the adhesive wrapper, and both are substantially centered on the table 10. As shown, the table 10 is supported by a pair of telescopic legs 11, each having an upper portion 12 and a lower portion 13 comprising an air cylinder which continuously exerts upward air pressure upon the upper member 12, thus causing the table 10 to "float" upon a cushion of pressurized air. This is an important and advantageous feature of the invention, as will further become apparent hereinafter. It should be said at this time, however, that the dot-dash line position of table 10 appearing in FIG. 2 of the drawings illustrates the manner in which the table may be depressed under the influence of a downwardly directed force, for reasons which will become apparent hereinafter.

Spaced from the table 10, and substantially aligned with it, is a shuttle comprehensively designated with the number 14, supported on legs 15 and supported by a brace 16. The shuttle 14 includes a pair of tracks 17, 17 which extend the entire length of the shuttle and, as shown in FIG. 1, are spaced outwardly of the table 10 and extend substantially the length of the table 10. The shuttle has a rigid, substantially horizontally arranged press plate 20 which is critically spaced slightly above the level of the table 10, and which is arranged to reciprocate back and forth above the level of the table 10, for a purpose which will be described in further detail hereinafter. The press plate 20 is driven in reciprocation, back and forth above the level of the table 10, by a drive means including a motor 21, a gear box 22, a chain 23 acting with sprockets 24, 25 to drive a cross shaft 26 having pinions 27, 27 at its ends, meshing with the tracks 17, 17. The motor 21 is fixed upon support plates 30, 30 to the press plate 20. Accordingly, when the motor is energized in one direction, the pinions 27, 27 are rotated on the tracks 17, 17, causing the press plate to move in the direction of the table 10. When the motor 21 is actuated in the opposite direction, the press plate is withdrawn away from the direction of the table 10.

The forward end of the press plate 20 is supported on a shaft 31 carrying at its ends rollers 32, 32, which roll within a "C" iron 33 carried beneath each of the tracks 17, 17. The back of the press plate 20 is supported for reciprocating movement back and forth with respect to the table 10.

Details of the track 17, C iron 33, wheels 32 and related structure appear in further detail in FIG. 3 of the drawings.

Carried at the forward end of the press plate 20, and mounted upon supporting plates 34, is a roller 35 which is rotatably mounted for free rotation with respect to the press plate 20. The roller is preferably spaced forwardly of the leading edge 36 of the press plate 20. This spacing is a highly important and advantageous feature of this invention, as will further become apparent hereinafter.

It will be appreciated that automatic electrical actuators and controllers which are of themselves well known in the art, may be provided for automatically causing the shuttle 14, including the press plate 20 and the roller 35, to reciprocate in accordance with a predetermined, timed operation, without requiring the attention of the operator. Since such electrical actuating devices, together with any time delay circuits that may be desired, are well known in the art, they have not been specifically shown in the drawings. However, such circuits may be arranged to cause the shuttle 14 to move toward the left as shown in FIGS. 1 and 2 in a manner to compress, roll and wrap the foam, and at the correct time, to retrace its path and to withdraw from the table 10, liberating the compressed foam package for mechanical or manual handling. Further, such circuitry can provide for a suitable time dwell for the shuttle 14 in its withdrawn position, followed by automatic actuation after the operator has had an opportunity to place a fresh foam sheet S and a fresh wrapper W upon the table 10.

Turning now to FIGS. 4A through 4E, the unique and important structure and operating features of the apparatus will further become apparent. Referring first to FIG. 4A, it will be observed that the leading edge 36 of the press plate 20 is moving toward the left, in the direction indicated by the arrow (a) in FIG. 4A. The roller 35, which is spaced forwardly of the leading edge 36 by a space indicated by the number 40, has contacted the leading edge S' of the foam sheet S, and has partially buried itself within the foam sheet, causing an upward curling of the leading edge S', which curling is particularly apparent in FIG. 4A.

As the press plate 20 continues in the direction indicated by the arrow (a), as shown in FIG. 4B, the leading edge S' is pinched back upon itself beneath the press plate 20, and the roller 35 continues to depress the foam sheet S, flattening it and arranging it in a perfect attitude for the commencement of the rolling operation wherein the foam sheet S is concurrently compressed and rolled upon itself. FIG. 4C shows the continued rolling of the sheet S upon itself, and the arrow (b) in FIG. 4C indicates the downward movement of the table 10 under the influence of the pressure exerted by the accumulation of a mass of foam sheet S between the press plate 20 which continues to maintain a fixed horizontal position because its movement is guided by the rigid tracks 17, 17 and C irons 33, 33.

FIG. 4D shows a further step in accordance with the method of this invention, illustrating the static pickup of the adhesive wrapper W, further attended by a fur-

ther downward movement of the table 10 as indicated by the arrow (b) in FIG. 4D. In the stage of the wrapping operation illustrated in FIG. 4E, the wrapper W, together with its adhesive portion A, has contacted the foam sheet and is adhered to it under pressure. The adhesive completes the wrapping step and prevents any loss of compression in the compressed foam roll after the press plate 20 has been withdrawn and the package has been freed for further handling.

It is important to note that throughout the rolling operation the pneumatic cylinders 13, 13 are continuously urging the table 10 upwardly against the foam, while the press plate 20, which is substantially immovable in the vertical direction, provides a resisting force. Thus, the table 10 and the press plate 20 cooperate to exert a constant and vertical pressure upon the foam throughout the entire rolling and wrapping operation. This provides a uniformity of compression and results in the production of a particularly tightly compressed and uniformly distributed rolled foam sheet.

It is to be particularly emphasized that the presence of the roller 35, spaced forwardly of the leading edge 36 sets up the leading edge of the foam sheet S, even in situations where the foam sheet S is initially so thick that it has a vertical height that is greater even than that of the press plate 20. Such a configuration is shown in FIG. 2. The roller 35 has the capability of penetrating into and rolling upon the leading edge of the foam sheet S, even when such sheet is very thick, and of turning up and curling the leading edge of the foam sheet S in such a manner that it is presented in a proper attitude for rolling contact by the leading edge 36 of the press plate 20.

It will be appreciated that the table 10 may be constructed of wood or any other desirable material. However, it is preferable to provide it with a friction surface such as the surface 50 appearing in FIGS. 4A through E, in order to prevent any sliding movement of the foam S or of the wrapper W during the rolling operation. The air pressure in the cylinders 13 may be regulated to any desired pressure, thus controlling the tightness of the final roll. Of course, springs or other means may be utilized instead, provided they continuously exert an upwardly directed pressure upon the table 10.

Similarly, it will be appreciated that the structure may be modified to provide a stationary table 10 and a press plate 20 which is continuously urged in a downward direction. Further, modifications may be made wherein the press plate 20 is stationary and wherein the table 10 is reciprocated back and forth, all as will become apparent to those skilled in the art. Similarly, the pressure imposed upon the roll may be applied by both the table and the press plate, and adjustments may be made with respect to pressure on either one or both.

Various substitutes may be provided for the shuttle drive assembly, substituting for the electric motor mounted on top of the shuttle. This reciprocating movement may be accomplished by pneumatic cylinders, other electrical means, hydraulic cylinders, drive chains, etc.

Although it is highly desirable and preferred to utilize the roller 35, and to space it from the leading edge 36 of the press plate 20, it will be appreciated that in some situations (especially when the foam sheet S is not very thick) to dispense with the use of such roller or to dispense with the spacing between the roller and the leading edge of the press plate 20.

The wrapper sheet W may be composed of a wide variety of suitable materials, but it has been found that a polyurethane film is ideal, not only because of its properties of strength but because it tends to pick up static electricity which causes it to cling to the roll during the rolling operation, thus minimizing or eliminating the need for an adhesive layer edge of the wrapper W. Obviously, it is possible to substitute other materials and, if necessary, to provide an adhesive layer at the leading edge of the wrapper W.

It will further be appreciated that means may be provided for automatically feeding the sheet material and the wrapper at proper times during the cycle of operation of the machine, and that the product may be automatically picked up and handled by automatic conveying devices. Indeed, the operation of the apparatus in accordance with this invention may be ideally integrated into an overall production operation wherein the foam material itself is continuously produced, trimmed, slit, convoluted and fed into the machine, and then automatically picked up and packaged.

There is virtually no limit to the length or width of foam sheet that can be processed with an apparatus and method in accordance with this invention. The tracks 17, 17 and the C irons 33 may be made of almost any length, as may the table 10. Thus, lengths even as great as 50 to 60 feet or more may be handled conveniently and efficiently, with great economy, in accordance with this invention.

As a further alternative, it should be kept in mind that in some cases it is possible to operate with neither the table nor the press plate movable in the vertical sense toward or away from each other. In such a situation, it is preferable to arrange the table at an inclination with respect to the press plate 20, so that as the sheet material is rolled up and occupies space between the table and the press plate, more space is continuously provided.

Although this invention has been described in conjunction with the pinching and rolling of the sheet material itself, it is possible to provide continuous rolls for winding the sheet around a central roller or core, and causing it to compress and to be rolled up in accordance with this invention.

It will be appreciated that many other modifications may be made without departing from the scope of this invention. For example, certain parts may be used independently of others, parts may be reversed, and equivalent elements may be substituted for those selected for illustration in the drawings, all without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In an apparatus for producing a compressed rolled package of resilient foamed sheet material, the combination which comprises

- a. means forming a support upon which said foamed sheet material may be laid,
- b. a carrier movable in reciprocation back and forth between a withdrawn position and an operative rolling position along said support and in close running clearance above said support, and having a leading edge which faces toward said operative rolling position on said support,
- c. a roller extending across the leading edge of said carrier and arranged to contact an edge of said foamed sheet material as said carrier is moved from said withdrawn position toward said operative rolling

position and having the capability of rolling upon and penetrating into said edge of said foamed sheet material, and

d. means for maintaining said carriage at a predetermined level above the surface of said support while said carrier is moved through said operative rolling position, at a level above said support but at least a portion of which is below the upper surface of said foamed sheet material at the beginning of the rolling operation.

2. The apparatus as defined in claim 1, wherein a roller is provided ahead of the leading edge of said carrier and means are provided for spacing said roller from said carrier.

3. The apparatus as defined in claim 1, wherein means are provided for spacing said roller above the level of said support but at least a portion of which extends below the upper surface of said foamed sheet material.

4. The apparatus as defined in claim 1, wherein means are provided for yieldably urging said carrier toward said support.

5. The apparatus as defined in claim 1, wherein said support includes an area for the support of a separate adhesive wrapper the foam sheet supporting area being located between said adhesive wrapper support area and said withdrawn position of said carrier.

6. In a method of making a compressed, rolled package of resilient, compressible foamed sheet material, the steps which comprise:

- a. supporting said material on a substantially flat support,
- b. advancing a cylindrical roller from a remote position along said support toward and into rolling pressure engagement over the front portion of said material, compressing said front portion of said material under said roller and causing the compressed front portion of said material behind said roller to curl up against the trailing surface of said roller,
- a. advancing behind said roller toward said material and into pressurized engagement therewith a carrier having a leading edge that is spaced above the level of said support at a distance less than the thickness of said material,
- d. folding over upon itself the curled up compressed front portion of said material under said front edge of said carrier, and
- e. continuing the advancement of said carrier to compress said material beneath said leading edge and then roll up said material to form a compressed rolled package.

7. The method defined in claim 6, wherein the material is rolled up in a wrapper comprised of a substance having the property of statically clinging to the rolled material.

8. The method defined in claim 6, wherein said carrier is yieldably urged toward said support while said material is rolled up under said carriage.

9. The method defined in claim 7, wherein said wrapper is provided with adhesive at an end thereof and is somewhat longer than the circumference of the rolled material, which includes the steps of

- a. disposing said wrapper in flat condition on said support in the path of rolling movement of the rolled material with the adhesive end portion of said wrapper positioned farthest from said rolled material,

7

- b. rolling said rolled material over the flat wrapper, thereby causing said wrapper to adhere to said roller material and wrap around it, and
- c. continuing the rolling operation until said wrapper

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overlaps itself, with the adhesive bending the overlapping portions of said wrapper to form a wrapped package in which loss of compression is prevented.

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