May 23, 1967 J. P. SCHAFER 3,320,716

METHOD AND APPARATUS FOR CONTINUOUS PACKAGING OF FRAGILE ITEMS

Filed July 31, 1964 4 Sheets-Sheet 1

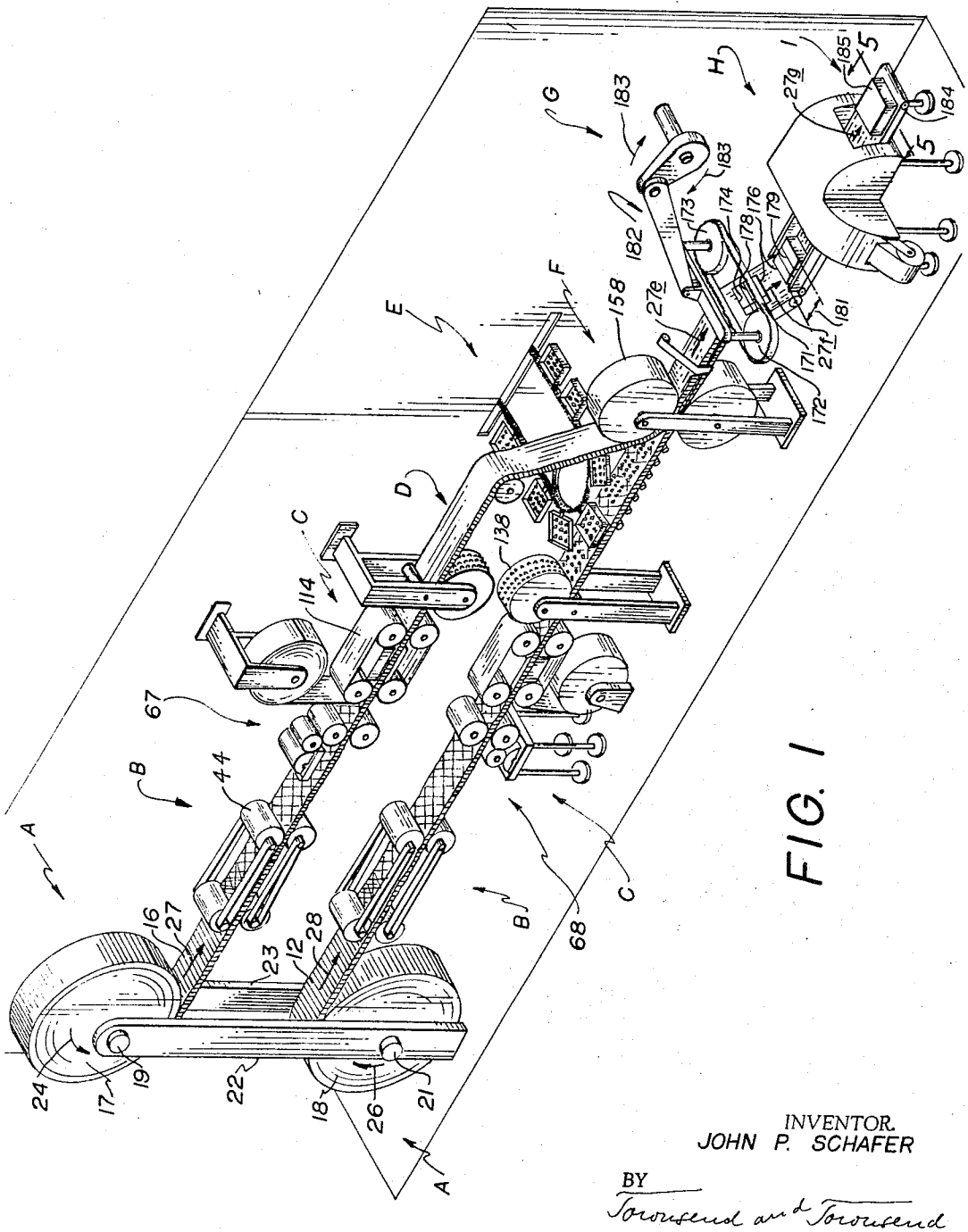


FIG. 1

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Filed July 31, 1964 4 Sheets-Sheet 2

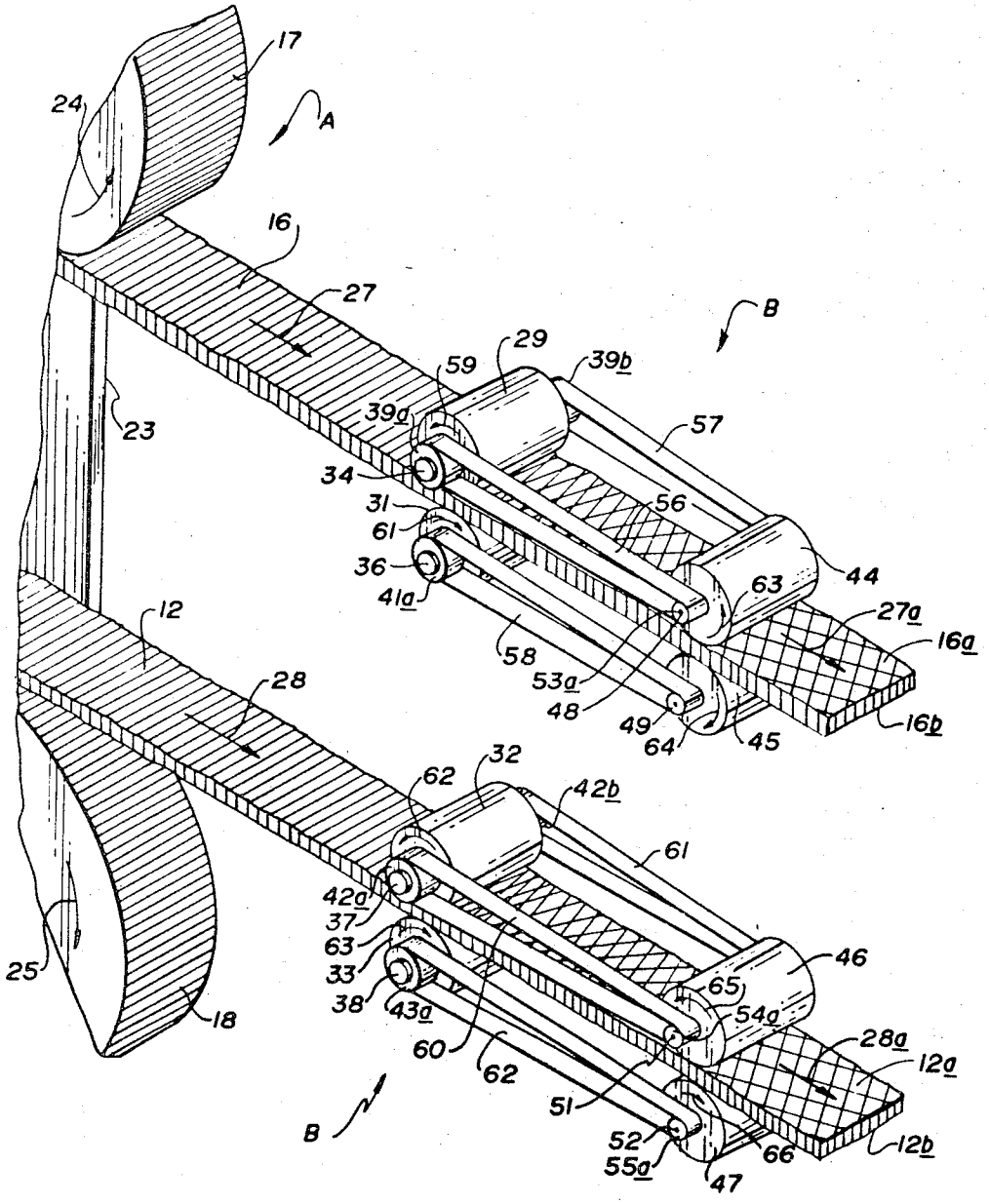


FIG. 2

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METHOD AND APPARATUS FOR CONTINUOUS PACKAGING OF FRAGILE ITEMS

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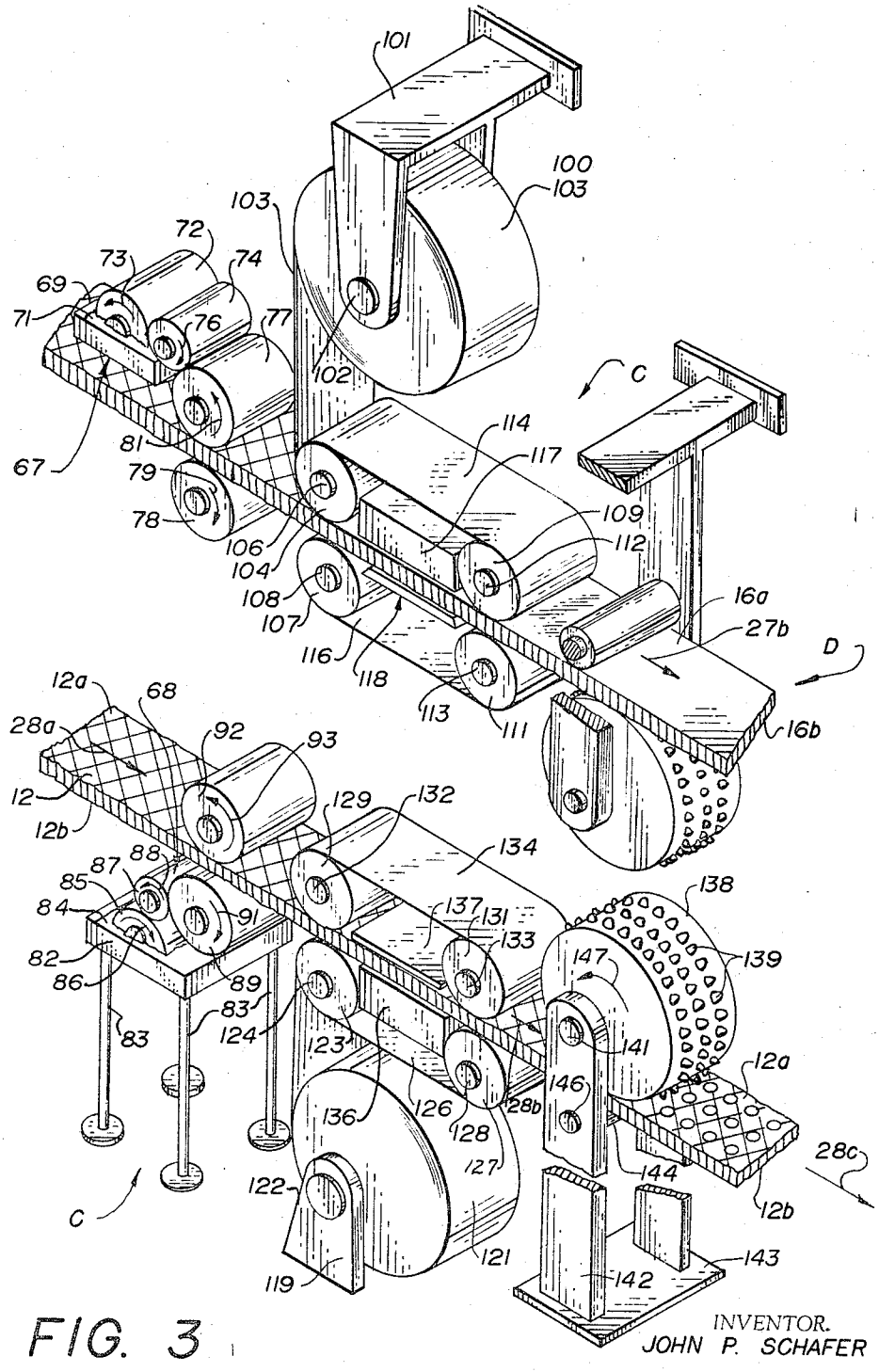


FIG. 3

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METHOD AND APPARATUS FOR CONTINUOUS PACKAGING OF FRAGILE ITEMS

Filed July 31, 1964 4 Sheets-Sheet 4

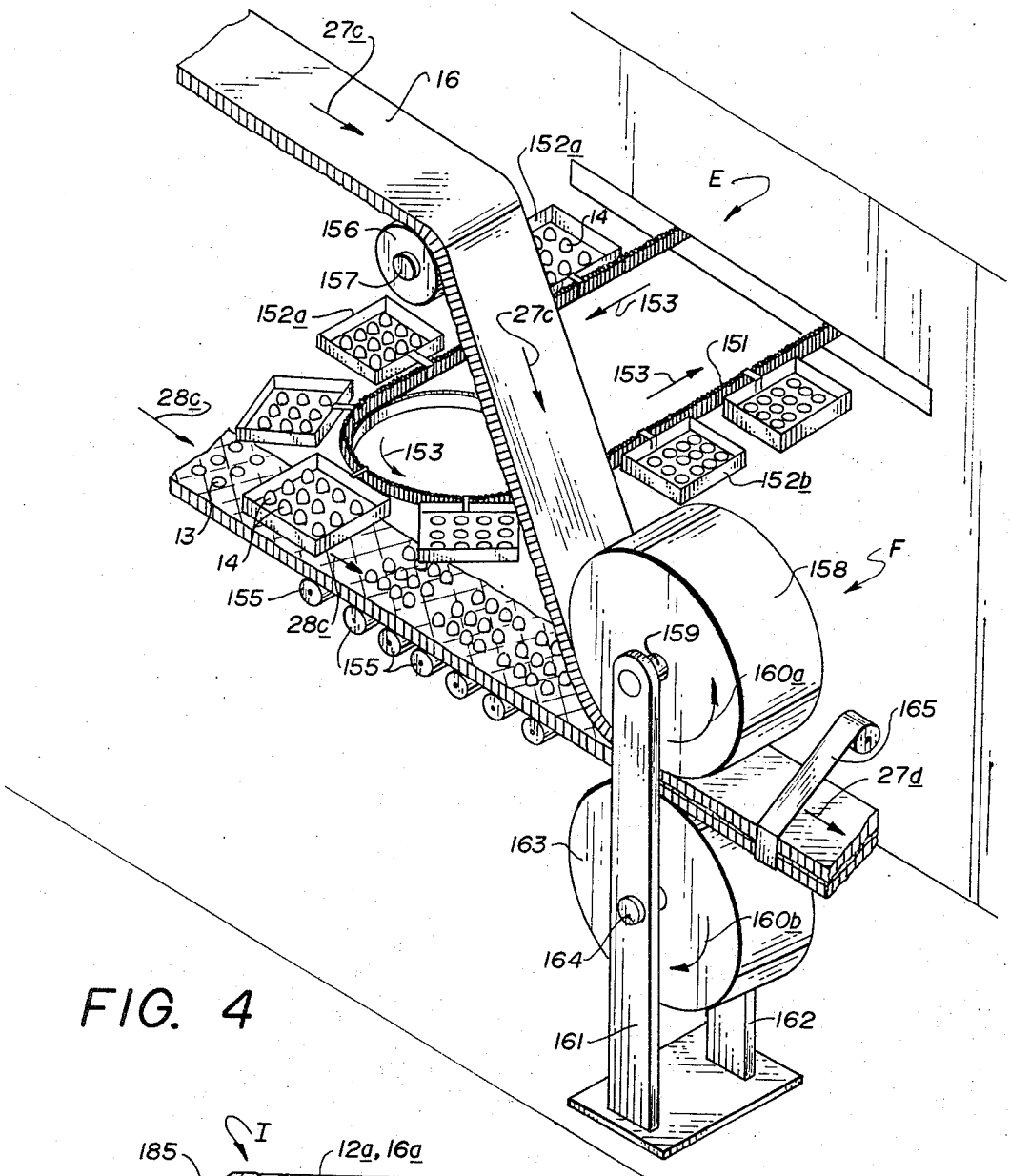


FIG. 4

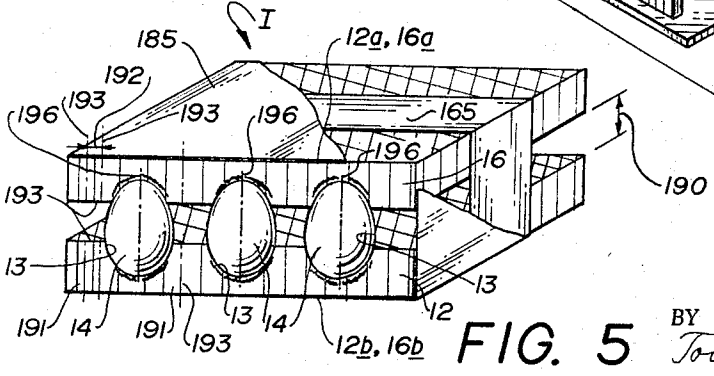


FIG. 5

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3,320,716

METHOD AND APPARATUS FOR CONTINUOUS PACKAGING OF FRAGILE ITEMS

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Filed July 31, 1964, Ser. No. 386,539
14 Claims. (Cl. 53—27)

This invention relates to the packaging of items and more specifically to apparatus and process for packaging items between adjacent layers of expanded honeycomb material to form a novel, energy-absorbent parcel capable of resisting shock loads without damaging the packaged contents therein.

In various phases of the packaging and materials handling industries, particularly but not necessarily limited to those dealing with fragile items such as eggs, light bulbs, electronic components, and the like, there has been a long-felt want for a continuous method of packaging such contents and producing a parcel capable of resisting shock loads while protecting the contents therein from damage.

When open cell honeycomb material is subjected to a compressive force parallel to the longitudinal axes of the cells, the cell structure initially exhibits high resistance to such imposed forces. After initial crushing occurs, the resulting crushed cells exhibit a low but constant resistance to further deformation until a point is reached where the cell walls have been entirely, substantially compressed. Because of the numerous materials from which honeycomb may be manufactured, a wide variety of cell strengths and energy-absorptive capabilities, as a result of the aforementioned crushing, are available. Accordingly, I have sought to incorporate these features, among others, of expanded honeycomb cell material which has been initially crushed into my invention which includes a novel incapsulation of a product in an energy-absorption medium. Such incapsulation produces a packaged sandwich capable of absorbing the energy of deceleration produced by an object therein and hence protect the contents from damage when exposed to various types of shock loads.

Thus it is an object of this invention to provide apparatus for processing continuous strips of unexpanded honeycomb material into expanded honeycomb sheets, placing articles to be packaged on one of the sheets, and crushing the ends of the honeycomb cells of the two sheets with the articles placed therebetween by impressing the two sheets towards each other. The resulting combination of contents packaged between the crushed sheets of honeycomb result in a shock absorbent honeycomb sandwich package.

Another object is to provide, in combination with a continuous packaging line utilizing expanded honeycomb sections, special means to cause a series of indentations conforming to the shape of the items to be packaged, to be crushed into the median faces of each of the sections. Thus contents which would normally roll across a continuously conveyed packaging strip when deposited thereon may be placed in such indentations and held securely for completion of the packaging process.

A feature of this invention is that while being continuously conveyed through my novel packaging apparatus, sheets of facing material required prior to any step of crushing may be continuously applied with or without printed matter thereon to the opposite outer median faces of the honeycomb sections.

It is also my object to teach a method for combining adjacent strips of single faced expanded honeycomb material with articles confined therebetween thereby producing an incapsulation of a product in an energy-absorption medium. Such a package is particularly suited for the handling, storage, distribution and marketing of items of all types but particularly those that are fragile and subject to breakage when exposed to rapid deceleration such as sudden shock.

A feature and advantage of this invention is that honeycomb materials may be selected with desired values of crushing resistance along the indented median faces of expanded sections. Moreover, the material may be selected with an initial compressive resistance that is safely below the crushing strength of the articles to be confined between the sections. Thus the articles themselves may be used safely, when deposited thereon, as impression dyes to crush their own profiles into the honeycomb strips being pressed together. Thus a novel package sandwich is produced having its contents held firmly and snugly in place without danger of movement when subjected to shock.

Another object of this invention is to teach a process whereby articles to be packaged are continuously deposited on the median face of one conveyed strip of honeycomb material while another strip is juxtapositioned and pressed thereon, bound thereto, the entire sandwich overwrapped, if desired, and then cut or otherwise severed from the continuously conveyed package sandwich to form a plurality of smaller packages ready for handling, storage, distribution or marketing.

Depending upon the distribution of articles within the package, the cutting may be either at right angles to the direction of travel along the conveyor line or parallel thereto, or a combination of both.

Another feature and advantage of this invention is that once there is formed an incapsulation of a product in the energy-absorption medium, i.e. between two honeycomb sections with crushed indentations to receive the articles therein, the final package form may be completed in a number of ways. Final sealing and forming of the packaged parcel may be accomplished by allowing a surplus of facing material, which may be heat sealed at the edges or adhesively joined. Alternatively, the honeycomb package may be slipped into a protective sleeve which may either surround the honeycomb package about the exposed edges of the longitudinal sections of the cells, or such a sleeve may be applied at the outside median surfaces and edges.

Another object of this invention is to teach a novel energy-absorbent package comprised of honeycomb sections and contents therebetween but which may be produced on other apparatus and by other methods, including manually, than those disclosed herein.

Other numerous objects, features and advantages of my invention shall become apparent from a reading of the detailed specifications which follow. However, it is understood that these specifications merely exemplify one embodiment of my novel apparatus practicing my new method for producing a new and novel packaging product and it is not intended to limit the scope of my invention.

Turning now to the drawings:

FIGURE 1 is a perspective view of one embodiment of my novel apparatus combination.

FIGURE 2 is a perspective view of one section of the apparatus shown in FIGURE 1 and enlarged.

FIGURE 3 is a perspective view of another section of the embodiment shown in FIGURE 1 and enlarged.

FIGURE 4 is a perspective view of a third section of the embodiment of my invention shown in FIGURE 1 and enlarged.

FIGURE 5 is a partial sectional perspective of the novel product of this invention showing one type of contents that may be packaged therein.

This invention in one embodiment comprises apparatus for the continuous packaging of articles between two strips of expanded honeycomb material which may be

uncoiled from adjacent rolls of unexpanded honeycomb material, an assembly of adjacent opposite pairs of differential rollers with which to expand the honeycomb material into open cell honeycomb strips, and a facing roll assembly to adhere suitable facing material on the extreme opposite face of each strip. Both strips may then be continuously indented by means of an indenting roller to form depressions on the unfaced surfaces to conform to articles desired to be packaged. The articles may be conveyed by means of a conventional endless belt conveyor directly above the indentations formed in one of the honeycomb strips and deposited therein. The article-laden strip of honeycomb strip is then superimposed with the other strip of honeycomb material in a manner such that the indentations in the second strip fit over the articles previously placed in the indentations of the first strip. Both strips are then conveyed between two soft impression rollers where the entire sandwich is pressed together. This step is particularly essential when preindentation of the strips to conform to the articles to be placed therein is omitted and the articles are merely placed on the strip to form their own crushed impression profiles when passed between the soft rollers. The latter alternative may be used when the shape of the object is such that there is no tendency for the articles to roll from the face of the honeycomb section in the absence of indentations. Thus the contents are packaged in place between the two honeycomb webs. Upon leaving the compression zone of the impression rolls, the two strips of honeycomb material which confine the articles therebetween may have a tape or other suitable binding applied therearound to form a relatively permanent package sandwich. The continuous strip of packaged sandwich may now be cut into packages of any desired length by conventional means such as an oscillating band saw. In addition, depending upon the distribution of articles between the honeycomb strips, the package may also be cut longitudinally to form additional smaller packages. The entire incapsulation may then finally be overwrapped, if desired, to form a novel package ready for storage or distribution and marketing.

The invention is best understood by referring first to FIGURE 1 of the accompanying drawings which shows a typical embodiment of my invention with a pair of adjacent rolls of unexpanded honeycomb strip material indicated generally at A, expansion stations indicated at B, and facing roll assemblies indicated generally at C. Indentor rolls and mounting are indicated at D associated with expanded honeycomb strips **12** and **16**. A conventional endless belt conveyor station is shown generally at E for depositing articles to be packaged into the indented portions **13**, shown in FIGURE 4, of strip **12**. After depositing articles **14**, shown in FIGURE 4, in the plurality of arranged indentations **13**, article-laden honeycomb strip **12** is joined with honeycomb strip **16** in the region of the impression rolls indicated generally at F. The combined honeycomb strip sandwich may then be bound and conveyed to a sawing station indicated generally at G, whereafter the cut lengths of sandwich or packages may be finish wrapped at the overwrapping machine indicated at H. The novel product of this invention, the combination of honeycomb shock absorbing material, contained articles and, if desired, overwrapping is indicated generally at I ready for storage or distribution and marketing.

The process herein is initiated at each of two rolls **17** and **18** as shown in FIGURE 1 which are supported on adjacent parallel pins **19** and **21**, respectively, which in turn are mounted between support columns **22** and **23** by conventional means known in the mechanical art and not further described herein. As roll **17** is rotated in the direction indicated by arrow **24**, and roll **18** in the direction indicated by arrow **25**, strips **16** and **12** wound on the rolls, consisting of paper or other suitable unexpanded honeycomb, are conveyed in the direction indicated by arrows **27** and **28**, respectively, into the nip of expansion holding rollers **29** and **31**, and **32** and **33**, respectively. The expansion holding rollers are supported on axles **34**, **36**, **37** and **38**, respectively, in a conventional manner not further described nor shown in the drawings to which are attached pairs of equal diameter pulleys **39***a* and *b*; **41***a* and another similar thereto but not shown; **42***a* and *b*; and **43***a* and another similar thereto but not shown. Spaced a short distance forward of the holding rollers are expansion pull rollers **44**, **45**, **46** and **47**, the first two associated with honeycomb web **16** and the latter two with web **12**. The pull rollers are mounted on axles **48**, **49**, **51** and **52**, respectively. On each of the latter axles are mounted concentrically equal diameter pulleys **53***a* and another similar thereto on the opposite side of roller **44** but not shown; **53***b* and another on the opposite side of roller **45**, not shown; **54***a* and another not shown; and **55***a* and another not shown. Each of the latter pulleys **53***a* to **55***a* and its opposite member, not shown, are of a smaller diameter than the forwardly adjacently located and corresponding pulleys **39***a* to **43***a* and its opposite member, not shown, mounted on the axles supporting expansion holding rollers **29** to **33**. Each of the adjacent set of pulleys **39***a*–**53***a*, **41***a*–**53***b*, etc., through those opposite **43***a*–**55***a* and not shown, is provided with a continuous endless friction drive belt: **56** for **39***a*–**53***a*, **58** for **41***a*–**53***b*, etc., through belts **57**, **58**, **60**, **61**, **62** and a last belt connecting the pulleys on the side of rollers **33** and **47** not seen in FIGURE 2. Each of the expansion holding rollers **29**, **31**, **32** and **33** are powered by conventional means not shown nor described herein which cause the rollers to rotate in the direction indicated by arrows **59**, **59′**, **64** and **64′**, respectively. Due to the smaller diameter of the pulleys mounted on the axles of the expansion pull rollers, and the action of the endless friction drive belts **56** through **62**, pull rollers **44** to **47** are rotated in the direction indicated by arrows **63**, **63′**, **65** and **66**, respectively, but at an angular rate of rotation greater than that of the rollers associated with the forward pulleys that drive endless belts **56** to **62**. With the unexpanded honeycomb material associated with web **16** frictionally engaged between the holding rollers **29** and **31**, strip **16** is passed therebetween at a linear speed equal to the circumferential speed of the aforementioned rollers; at the same time the portion of the web frictionally engaged between pull rollers **44** and **45** are passed therebetween at a greater linear speed due to the increase in circumferential speed of the latter rollers as a result of the pulley and belt arrangement explained hereinabove. Since the web is pulled between the nips of rollers **44** and **45** at a greater speed than holding rollers **29** and **31** pass the web therebetween, the unexpanded honeycomb material is pulled and expanded to form open cell honeycomb strip material between the two sets of rollers with the open ends of the cells terminating to form median faces **16***a* and **16***b* of strip **16**. The median faces are characterized by the fact that the longitudinal axes **193** of typical cells **191**, seen in FIGURE 5, are normal to the median faces. Expanded honeycomb strip **16** is then continuously conveyed in the direction indicated by arrow **27***a*. Similarly by the action of holding and pull rollers **32** to **47** associated with web **12**, expanded honeycomb material is formed having median faces **12***a* and **12***b* with longitudinal cell axes perpendicular thereto and conveyed in the direction indicated by arrow **28***a*.

Located away from the expansion rollers in the direction indicated by arrows **27***a* and **28***a* are the facing adhesive applicators indicated generally at **67** and **68** associated with webs **16** and **12**, respectively, and seen in greater detail in FIGURE 3. Assembly **67** comprises adhesive reservoir **69** containing a suitable adhesive material **71** into which is dipped roller **72** supported in a conventional manner not shown or described further herein and rotated in a direction of arrow **73**. As drum

72 is rotated and dipped into the adhesive bath 71, a film of adhesive is picked up and applied to reflex drum 74 also arranged in a manner known in the art and not further described here. Drum 74 is in tangential contact with both drum 72 and applicator drum 77 and rotated in a direction indicated by arrow 76 so that the adhesive from drum 74 is transferred to drum 77, supported in a manner similar to the other drums. Drum 77 in turn is in tangential contact with the upper outer surface of the open ends of the cells of web 16 so that an even film of adhesive material is deposited thereon as the web or strip is conveyed past and in tangental contact with drum 77. Directly below drum 77 is support frictional roller 78 mounted and powered in a conventional manner to rotate in the direction indicated by arrow 79. The frictional contact of roller 78 with the underside of strip 16 stiffens the latter to enable application of the adhesive from drum 77 and also coact therewith frictionally to convey the web and cause rotation of drum 77 in the direction indicated by arrow 81. In a similar manner the facing adhesive applicator indicated at 68 comprises reservoir 82 supported on legs and bases 83. The adhesive reservoir contains adhesive material 84 which in a manner similar to that described above for assembly 67 is picked up by drum 85 rotating in a direction indicated by arrow 86 which applies glue to reflex drum 87 rotating in a direction indicated by arrow 88. Drum 87 thereby coats a layer of adhesive on applicator drum 89 rotating in a direction indicated by arrow 91. Frictional roller 92 rotated in a direction indicated by arrow 93 is mounted above drum 89 and in tangential frictional contact with the upper surface of web 12. Thus web 12, in a manner similar to web 16, is coated with a layer of suitable adhesive material on the lower surface at the edges of the exposed and expanded web and conveyed in the direction of arrow 28*a* at the same time.

The facing roll indicated generally at C and associated with web 16 comprises support bracket 101 within which there is mounted shaft 102 supporting roll 100 of printed or unprinted facing material 103. Facing material 103 is conveyed between the nip of roller 104 and conveyed web 16 adjacent to the face which has been coated with adhesive hereinabove described. Roll 104 supported in a conventional manner by shaft 106 is in vertical alignment with a similar roller 107 supported on pin 108. Spaced forwardly of rolls 104 and 107 are rolls 109 and 111, respectively, supported on pins 112 and 113. Wrapped around rollers 104 and 109 is continuous, endless sealing belt 114, and between rollers 107 and 111 a similar belt 116. Mounted between rollers 104 and 109 is a conventional heater assembly 117 of a type known in the art and not further described herein; directly below the heater and on the underside of conveyed web 16 is a conventional compression plate 118 used with heaters of the type shown by assembly 117. Thus as facing material is unwound from roll 103 and pressed into contact with web 16 on the surface coated with adhesive material and continuously held in close contact under pressure therewith by means of the endless belt 114, heater body 117 and compression element 118, said facing material is permanently applied to the median face 16*a* of expanded honeycomb strip 16. By the heating action of heater 117 conducting heat to and through belt 114, the wet adhesive between the facing material and median face 16*a* is dried and the honeycomb strip is ready for further processing as it proceeds from the station indicated by and in a direction of arrow 27*b*.

A facing roll station also indicated generally by letter C is associated with strip 12 and comprises floor bracket 119 supporting the printed or unprinted facing roll 121 on shaft 122. A suitable facing strip is unwound from roll 121 and introduced between endless belt 126 supported on roller 123 on pin 124 and the bottom face of strip 12 to which suitable adhesive material has been applied as hereinabove described. Associated with roller 123 is roller 127 supported on shaft 128 around which endless belt 126 is wound and the pair of rollers 129 and 131 supported on pins 132 and 133, respectively, around which is wound endless belt 134. Heater 136 is of a type substantially similar to 117 and operates in conjunction with compression plate 127 in a manner similar to that of plate 118 as explained hereinabove. Again, as in the case of strip 16, strip 12 emerges from the facing roll assembly region at the point indicated by and moving in the direction of arrow 28*b* where said strip is in a condition for further processing with lower median face 12*b* covered with a suitable facing material.

Expanded honeycomb strips 12 and 16 which have been faced on their opposing outer surfaces with a suitable facing material are then conveyed to the indentor assembly generally indicated at D. An indentor roll 138 having a plurality of protrusions 139 is supported on axle 141 between brackets 142 on mounting base 143. As web material 12 passes into the nip of rollers 138 and 144, located in direct vertical alignment with 138 on shaft 146 and spaced away from indentor 138 a distance equal to the thickness of strip 12, the indentor roll rotated in a direction indicated by arrow 147 causes impressions of the shape of protrusion 139 to be crushed into the exposed ends of cells of median face 12*a* at regular intervals along strip 12. Impressions 13 and the protrusions 139 by which they are produced in the web are shaped to conform to the shape of articles 14 in respect to the portions of the latter which are to rest in web 12. Similarly an indentor roll shown directly above roll 138 but not further enumerated herein and with components similar to those detailed above in respect to roll 138, form indentations to conform to the shape of articles 14 in respect to the portions of the latter which are to rest in web 16.

As web 12 is conveyed along in the direction and in the region of arrow 28*c*, best seen by referring to FIGURE 4, an endless conveyor generally indicated at E and of a type known in the materials handling art and not described nor shown in detail, deposits a series of articles 14 from filled conveyor boxes 152*a*, attached to belt 151, into depressions 13. Emptied conveyor boxes 152*b* are further advanced in the direction of arrow 153 to a remote station not shown on the drawings where boxes 152*b* are again filled with articles 14 for repeated depositing in depressions 13 which are continuously impressed upon strip 12.

After loading with articles 14, strip 12 is supported on conventional idler rollers 155 and conveyed into the region of the impression rolls assembly generally indicated at F and also best viewed in FIGURE 4. At this station expanded and singly faced honeycomb strip 16 which has previously been indented as described above is conveyed in a downward direction as indicated by arrow 27*c* over deflector roller 156 on shaft 157. Strip 12 is concurrently conveyed over roller 163 supported on shaft 164 between brackets 161 and 162. Soft impression rolls 158 and 163 are spaced apart a distance such that the interval between the rolls is substantially equal to the finished thickness of the desired package of honeycomb strip and contents confined therebetween. As the sandwich comprising strips 12 and 16 and contents 14 pass between soft rolls 158 and 163, the contents residing in impressions 13 of web 12 are firmly pressed into the previously formed indentations and exposed median face 16*b* of web 16 to form a snug sandwich of confined contents between two shock absorbent honeycomb strips. It should be noted that the honeycomb strips are of such preselected depth that after the final sandwich form is completed, the adjacent median surfaces in the vicinity of the articles confined therebetween do not come into contact with each other and that an inner gap exists between the two strips. As the formed sandwich leaves the compression zone of impression rollers 158 and 163 rotating in the direction indicated by arrows 160*a* and

160*b*, respectively, said sandwich is conveyed in the direction indicated by arrow 27*d*.

After being conveyed from the impression rollers, the honeycomb strips which are not physically joined to each other may be bound or taped by suitable binder **165** to form an integral continuous strip of packaging with contents therein. The product may then be conveyed in the direction of arrow 27*e* into the cutting path of an oscillating band saw assembly indicated at G or other suitable severing device. If, for example, an oscillating band saw is used, as shown in FIGURE 1, rotating endless saw blade **171** may be mounted between a pair of rotating members such as pulleys **172** and **173** to cut the continuous packaging strip at preselected intervals resulting in cut faces **174** and **176** between consecutive tape strips **178** and **179**. The preselected intervals are spaced to form packages of a desired length indicated by dimension **181** and to contain the desired quantity of contents **14**. An oscillating band saw mounting is indicated generally at **182** and is adapted for rocking or oscillating in a direction indicated by arrow **183** at preselected intervals which causes saw blade **171** to make the desired cuts.

The article of manufacture of this invention is shown in greater detail in FIGURE 5. Articles **14** are shown residing in the indentations **13** hereinabove described in respect to strips **12** and **16**. Seen with particular clarity in FIGURE 5 is the gap between the median faces of the honeycomb package shown by dimension **190**. The gap is of particular importance to assure the energy-absorbent ability of the article into the crushed indentation of the honeycomb in case of sudden shock or the like. The gap must exceed the total maximum deflection that might occur when decleration of the package occurs in a direction substantially parallel to the longitudinal axes of the cells. It should be noted also that depending upon the shape of the indentation and the articles themselves a certain amount of crushed honeycomb is accumulated at oblique angles to the longitudinal axes of the cells thereby providing some shock resistance along lines of force substantially nonparallel to the longitudinal axes of the cells. It should be noted that gap **190** permits savings of material by eliminating that amount of thickness of the honeycomb section.

The material selected and the density or interval between cells as indicated by dimension **192** in FIGURE 5 is such that the initial compressive resistance to crushing at median interfaces **193** is less than the corresponding safe crushing load which may be resisted by contents **14** when the contents themselves are used as their own crushing dies. However, the honeycomb ribbon material is selected so that for a given density of cells the article contained therein under most conditions of severe deceleration is more likely properly cushioned to avoid damage.

Although I have described my invention above starting with a continuous roll of unexpanded honeycomb materials, it is understood that my invention may be practiced by introducing pre-expanded and cut sections of single faced honeycomb material immediately prior to the indentor assembly indicated generally at D in FIGURE 1. In such case, certain modifications may be made to my apparatus such as introducing an endless belt conveyor forwardly of the indentor assembly to convey the cut honeycomb sections through the stages of indenting and article loading. The articles to be packaged, however, may be introduced into the indentations produced by the indentor rollers in a manner similar to that described above in the case of the continuous strips **12** and **16**. The single faced honeycomb sections may then be placed with the articles residing therebetween in the indentations in a manner similar to that described above for the continuous sections except that certain modifications and provisions may be made to accommodate the precut section. After binding, if any the packages may ing and crushing a sandwich of honeycomb webs and contents confined therebetween, binding said sandwich to be introduced to a bundling and overwrapping machine such as that indicated generally at H of FIGURE 1 thus omitting the step of oscillating band saw cutting or other method of severing. However, the packages may also be cut longitudinally or otherwise into smaller parcels if desired.

Other variations of my invention are also possible such as providing single faced expanded honeycomb in continuous rolls thus omitting the apparatus and steps for expansion and facing.

As mentioned in the specification, the facing material, may be printed or unprinted; and in the case of printed facing material, any overwrap employed may be clear plastic or cellophane. Moreover, the facing material itself may be clear plastic or cellophane to provide visual inspection of the contents through the open cells of the honeycomb material.

As indicated earlier, the continuous encapsulation sandwich may be cut at right angles to the longitudinal axis of the encapsulating webs as shown at FIGURE 1. Also, a cutting or severing device may operate in a line or lines parallel to the longitudinal axis of the continuous packaging section. In this manner various combinations of products and packages are possible in a single packaging assembly line.

Another variation possible of my invention is to provide facing materials somewhat wider than the core material which forms the honeycomb portions of the package. If properly arranged and chosen from suitable material, the excess edges of such facing may be heat sealed or glued to form a fin around the sandwich to form a completed package.

Although I have shown my invention as applied to articles of one shape to be packaged, a variety of parts and articles of manufacture may be confined as the contents of my novel package; for example, precision parts such as those used in the automotive and aircraft industry; military packaging for air drops into water with sealed packs such as guns, food and ammunition; perishable fruits such as tomatoes, avocados, peaches, and the like; eggs; light bulbs; radio tubes; bottled goods such as soft drinks and perfumes. Also the novel apparatus and method of my invention may be employed by moving companies for preparing by new and improved package containing fragile glassware and china for shipment and storage.

Although the new process that I have shown as part of my invention is one that may be practiced by the novel combination of apparatus that I have set forth, it is understood that the process itself for producing my new package for various contents may be done in other manners using other apparatus or manually.

Although the foregoing specification sets forth in some detail one embodiment of my invention with some variations of my novel process and product also indicated, such details are by way of example for purposes of explanation and understanding; and it is understood that certain modifications and changes to the detailed specifications may be practiced within the spirit of my invention and scope of the appended claims.

I claim:

1. A method for packaging contents in an energy-absorbent receptacle comprising the steps of: providing adjacent strips of substantially the same width of unexpanded honeycomb material, expanding the material to open cell honeycomb webs having the longitudinal axis of the cells normal to the median faces of the webs, depositing on one of the faces of one of the webs contents to be packaged, conveying and juxtapositioning the median face of the other of the webs on the face of the web having the contents placed thereon, pressing the adjacent faces of webs together and crushing the cell walls thereof around the contents to be packaged, forming by said press-

form a relatively permanent sandwich, cutting the sandwich formed by said binding into desired lengths to form an energy-absorbent receptacle packaging the contents therein.

2. A method for packinging contents in an energy-absorbent receptacle comprising the steps of: providing adjacent rolls of substantially the same width of unexpanded honeycomb material, conveying the unexpanded material from the rolls, continuously expanding the conveyed unexpanded material to form a continuous strip of open cell honeycomb having the longitudinal axis of the cells substantially normal to the median faces of the expanded strips, continuously depositing contents to be packaged at preselected intervals on one of the median faces of one of the conveyed strips, placing one of the median faces of the other strip on top of the median face of the strip having the contents placed thereon, conveying and pressing the adjacent median faces of the conveyed strips around the contents placed by said depositing to form a sandwich of honeycomb strips and contents therebetween, binding the sandwich formed by said conveying and pressing around the regions confining the deposited contents to form a relatively permanently bound continuous sandwich, cutting the sandwich formed by said binding at intervals between the regions having the contents confined therein, and forming by said cutting a plurality of continuously conveyed energy-absorbent receptacles packaging contents therein.

3. The method for packaging contents as defined in claim 2 and wherein further, after said expanding to open cell honeycomb strips, indenting the strips at preselected intervals on the median faces thereof, said indenting in the form of a portion of the contents being packaged, and depositing the contents in the formed indentations with the contents oriented to fit therein.

4. The method for packaging contents as defined in claim 2 and wherein further after said expanding to open cell honeycomb strips, applying a layer of adhesive material to each of the strips on median faces furthest removed from each other, providing strips of facing material of substantially the same width as the honeycomb strips, applying the facing material to each of the median faces having adhesive material applied thereon, pressing the facing material to the median faces, and drying and adhering the facing material applied to the expanded honeycomb strips to form single face honeycomb sandwiches with the facing material on the median faces furthermost from each other.

5. A method for making energy-absorbent packages confining contents therein comprising the steps of: providing a pair of expanded honeycomb material sections of substantially the same size and having the longitudinal axes of the cells substantially normal to the median faces of the section, depositing contents to be packaged on one median face of one of the honeycomb sections, placing the other honeycomb section with the median face of the latter adjacent the face of the section having the contents placed thereon, pressing together the adjacent honeycomb sections and crushing by said pressing the edges of the cells of the adjacent honeycomb sections around the contents placed thereon until the median faces of the honeycomb sections define a gap between each other, binding together the sandwich formed by said pressing and crushing to form a relatively permanent honeycomb sandwich and energy-absorbent package confining the contents therein.

6. A method for making energy-absorbent packages in accordance with claim 5 and wherein after said providing a pair of honeycomb sections having the longitudinal axes of the cells normal to the median faces of the sections, indenting a median face of each of the sections in the form of a portion of the contents being packaged, and depositing the contents in the indentation formed by said indenting with the contents oriented to fit therein.

7. Apparatus suitable for the continuous formation of an energy absorbent parcel in the form of a sandwich by the encapsulation of fragile items with first and second strips of expanded honeycomb, comprising: means mounted in spaced relationship for providing first and second strips of unexpanded honeycomb; expansion means mounted proximal to each of said providing means for expanding said strips to form open honeycomb cells having longitudinal axes substantially normal to median faces of the strips; means for directing the first expanded strip along a first path; means adjacent said first path for spacing a plurality of said fragile items along one face of said first strip; means adjacent said first path for directing said second strip over said items juxtaposed said first strip; means for forcing said first and second strips into closer proximity than the thickness of said fragile items to collapse portions of said first and second strips and form separate indentations in each of said strips which partially correspond to the configuration of each of said items, thereby forming a sandwich of expanded honeycomb with the fragile items disposed therebetween; means mounted along said first path for enclosing the resulting continuous sandwich of honeycomb strips and plurality of items; and means for intermittently severing said continuous sandwich to form a plurality of smaller parcels.

8. The system for packaging contents as defined in claim 7 and further characterized by means mounted adjacent to said expansion means to form partial indentations in at least said first honeycomb strip on said face of said strip at preselected intervals corresponding to the subsequent disposition of said items by said spacing means so that said spaced items will be maintained on said first strip.

9. Apparatus as defined in claim 8 and wherein said indentation means comprises: a roller; support means mounted adjacent to said roller to support and rotate the roller; at least one protrusion on said roller shaped to conform to a portion of one of said plurality of items; and back-up means mounted on said support means in spaced relation to said roller to cause said protrusion to form an indented impression of the portion of the items to be deposited in a median face of the strip at preselected intervals thereon, said back-up means further causing said roller to convey the strip through said indentation means.

10. Apparatus as defined in claim 9 and wherein said roller is provided with a plurality of protrusions to conform to portions of said plurality of items.

11. A packaging machine for confining a plurality of contents to be packaged in a high energy absorbing receptacle comprising: a frame; first conveying means mounted on said frame to transport a first section of expanded honeycomb material; means mounted adjacent to said first conveying means to place the plurality of contents to be packaged thereon; second conveying means mounted on said frame to transport and deposit on the first section and contents placed thereon a second section of honeycomb material of substantially the same shape as the first section; means adjacent said first and second conveyor means for pressing said first and second sections of honeycomb material around the contents placed on the first section to collapse portions of said first and second honeycomb sections and provide separate indentations which partially correspond to the configuration of each of said plurality of contents; and securing means to bind the first and second sections of honeycomb material to form a relatively permanent high energy absorbing receptacle with the contents confined therein.

12. The packaging machine defined in claim 11 and further characterized by indentation means mounted juxtaposed to said first and second conveyor means to form on median faces of the first and second honeycomb sections indentations which partially correspond to the configuration of said contents; and lug means for aligning the indentations in said second honeycomb section with the indentations in said first honeycomb section so that the con-

ents will be placed in the indented impressions in fitted orientation.

13. Apparatus for packaging contents comprising a pair of rolls in spaced parallel relationship having strips of unexpanded honeycomb material wound thereon for unwinding and extending therefrom, expansion means mounted adjacent to said rolls to convey therethrough the strips extending from said rolls and expand the strips to open honeycomb cells having longitudinal axes substantially normal to the median faces of the strips, means associated with one of the strips to deposit on one median face thereof contents to be packaged, impression means mounted adjacent to said last means to place the other strip on the strip having the contents laid thereon and press both strips together around the contents being packaged to form a continuous sandwich of expanded honeycomb cores and contents therebetween, binding means mounted adjacent to said impression means to bind together relatively permanently the formed continuous sandwich, means mounted near said binding means to sever said continuous sandwich and form a plurality of packages comprising said strips relatively permanently held together and having the packaged contents confined therein, facing means associated with said strips mounted adjacent to said expansion means, said facing means comprising adhesive applicator means to apply a layer of adhesive to one median face of each strip on the faces furthermost from each other, face dispensing means to apply a strip of facing material of substantially the same width as the strips on the adhesive coated median faces thereof, and heater and compression means to press the facing material against the layer of adhesive and dry the adhesive layer.

14. A method for making energy-absorbent packages for confining contents therein comprising the steps of: providing a pair of expanded honeycomb material sections of substantially the same size and having the longitudinal axes of the cells substantially normal to the median faces of the section, depositing contents to be packaged on one median face of one of the honeycomb sections, placing the other honeycomb section with the median face of the latter adjacent the face of the section having the contents placed thereon, pressing together the adjacent honeycomb sections and at least partially crushing by said pressing the edges of the cells of the adjacent honeycomb sections around the contents placed thereon to form a sandwich of the honeycomb sections and contents confined therebetween and binding together the sandwich formed by said pressing and crushing to form a relatively permanent honeycomb sandwich and energy-absorbent package confining the contents therein.

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