

PATENT SPECIFICATION

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(54) TEXTILE MATERIAL PACKAGING APPARATUS

(71) We, TEX INNOVATION AB, a Swedish Company, of P.O. Box 5006, S-421 05 Vastra Frolunda 5, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates generally to an apparatus and method for packaging or wrapping systems. This invention relates to the treatment of goods or wares to be packaged or wrapped in a wrapping material.

Packaging of various commodities - e.g. consumer goods is common in the manufacture and distribution of such goods between the point of manufacture and the locus of distribution. Transportation and handling costs have, in recent years, increased significantly and as a result, the cost of goods has also increased. Such transportation costs are not only dependent on the weight of the products but also on the volume of space such goods occupy. Thus with bulky goods, it has been recognized that by reducing their bulk or volume the overall costs may be reduced and a more efficient operation can be obtained.

Most commodities, particularly consumer oriented ones are in fact packaged usually with an overwrap for protective purposes for shipment from a manufacturer to a distribution point. Thus, it would also be desirable to develop an efficient and economical system for packaging bulky compressible commodities in conjunction with an overwrap system.

According to the invention, there is provided an apparatus for wrapping and vacuum packaging a commodity comprising supply means for supplying a length of wrapping material, means for supplying a commodity, means for enveloping said commodity in said wrapping material, first and

second opposed surfaces mounted in opposed relationship and defining therebetween a commodity receiving area, said first surface being deformable in said commodity receiving area, means for supporting said first surface in a spaced-apart relationship relative to said other surface, means for causing said first surface to be brought into contact with said commodity in said commodity receiving area whereby said first surface is initially deformed in said commodity receiving area and subsequently outwardly therefrom to reduce entrapment of air in packaging the commodity.

The invention also comprises a method of vertically wrapping and subsequently vacuum packaging of a commodity in a flexible airtight package comprising the steps of supplying a length of flexible air impermeable wrapping material, vertically advancing said material in a predetermined fixed path from a first vertical station to a second vertical station, vertically positioning a commodity to be wrapped in the direction of vertical advancement of said material between said first and second vertical stations and in said fixed path, vertically enveloping said commodity with said material as said material advances from said first vertical station to said second vertical station to enclose said commodity within said material, and subjecting said enveloped commodity to a vacuum packaging step in which said commodity is initially compressed centrally and thereafter progressively outwardly.

The above wrapping and vacuum packaging apparatus and method is particularly adapted to be employed in a system for conditioning a fibrous material such as is in the form of a commodity - e.g. a textile material or textile garment, cushion or the like. In the overall system, there may be provided a treatment zone and a stabilizing zone, preferably in communication with

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each other with conveying means for conveying a commodity to and through the zone, during which a commodity is conditioned for subsequent wrapping and vacuum packaging. Such a system for conditioning will include means for providing a source of conditioning air, as otherwise outlined, having a predetermined relative humidity and temperature requirements, and for introducing a flow of the conditioning air into the treatment zones. There is also provided means for introducing a flow of the air into the stabilizing zone and means for removing the treatment and stabilizing zone spent conditioning air.

For use in carrying out the above, the conditioning apparatus may also include a loading or receiving port in communication with the treatment zone and a discharge port for the stabilizing zone. Any suitable conveying means may be employed for conveying a commodity to and through the conditioning apparatus. A retention or like chamber may be associated with the discharge port of the stabilization zone for retaining textile materials for subsequent processing. Typically, the conditioning apparatus may be a continuous tunnel varying in length and width depending on the type of material being treated - a suitable tunnel for textile material such as coats, jackets, etc. may be 5 - 40 meters. Each of the treatment and stabilizing zones may involve two or more stages each preferably including separate means for introducing the flow of conditioning air and means for withdrawing spent conditioning air at the respective stage. Preferably a balanced overall system is employed and the number of stages will depend on the type of product being conditioned with two or more stages being typical. Circulating means such as fans may be provided for each stage.

To supply conditioning air, any suitable means may be provided. This invention preferably carries out the process described in copending United Kingdom application Number 45383/77 (Serial No 1597243) filed herewith in which it is disclosed and claimed that fibrous materials such as textile materials, which are to be vacuum packaged, are conditioned by treating the materials to expose them to a gaseous environment sufficient to reduce the segment mobility of the fibers to a level below the segment mobility level of the fibers prior to treatment and which may be carried out in the treatment zone of the apparatus herein. Likewise, the relative regain level of the fibers, in the treatment zone, are lowered or reduced to a level below that level of the fibers prior to treatment, whereafter in the stabilization zone the segment mobility of the fibers is stabilized and following this, the textile materials may be then packaged

while the segment mobility and moisture regain levels are at the reduced and stabilized level.

In the apparatus of this invention, therefore, means for supplying conditioning air, may be any suitable means commensurate in scope with the teachings of the copending application or in the event that other general processing is carried out such conditioning means can be varied as desired. Typically, according to the teachings of the companion application, the conditioning air provided in the treatment zone will have a relative humidity of less than about 30% and a temperature below about 35°C.

The apparatus of the present invention which is eminently suitable for carrying out the process of the above copending application, can provide treated or conditioned textile materials in a relatively short period of time, typically, from 30 minutes to 2 or 3 hours with 1 hour being normal for garments such as coats, jackets, suits or the like. The conditioning apparatus utilizes a mixture of ambient air and conditioned air which has been treated to remove the relative humidity and to cool the air at the same time. Using this apparatus, and with the teachings of the copending application, the method of the copending application may be carried out in very short periods of time.

This invention also provides a device for mounting and suspending a commodity e.g. coats, etc., to be wrapped and which may be incorporated into and form a portion of a vacuum packaged product so that the wrapped product can be readily suspended from a rack.

One form of the device has a body portion for mounting or suspending a commodity, a hook portion spaced from the body portion for suspending the resulting wrapped commodity from a rack, etc., and a thin, flexible heat-sealable ligament between the body portion and the hook portion. In one form the body is a hanger-shaped portion e.g. of conventional construction to retain the coat with the ligament being connected to the body portion at one end and to the hook portion at the other end. Thus, the ligament may be incorporated into a package with the hanger located within the package and the hook located exteriorly of the package; and when the opposed walls of the package are sealed together, the ligament is actually incorporated into the seal. The ligament may be fixedly secured by means of adhesive, heat sealing etc., to the hanger if it is made of appropriate plastic material or the hanger may be provided with an aperture with the ligament extending to the aperture. The ligament may also be a continuous band with the band hooking onto the hook portion and extending to the aperture.

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In a further form, the hanger portion may be in a conventional form but with a continuous band provided between the hook of the hanger and the hook portion which suspends a wrapped commodity from a carrier. The ligament may be made of any suitable material - e.g. the same material as the wrapping material, and preferably the ligament is of a relatively thin nature.

A wrapping assembly comprises supply means for supplying a length of wrapping material having opposed wall sections, means for engaging and maintaining the opposed wall sections of the leading portion of the wrapping material in a spaced apart manner to form an open-top enclosure adapted to receive a commodity, means for advancing the wrapping material with the walls in a spaced apart manner from an initial starting position to a second or terminal vertical position along a predetermined path, means for vertically mounting a commodity to be enveloped by the wrapping material in the predetermined path so that when the advancing means advances the material from the first or initial position to a second or terminal position, the commodity is enveloped by the material as the material advances between the first and second positions. Conventional supply means for supplying a length of wrapping material may be used and preferably the arrangement described herein is utilized. While the supply means may supply an endless tube, the wrapping assembly of this invention may also be used for lay-flat film, C or U film, etc.

In the wrapping assembly, the most preferred form of the advancing means for maintaining the walls of a tube in an open condition comprises a pair of gripping means, preferably with suction or vacuum heads. This same means, travelling from the first to second vertical position will thus permit a vertically aligned or hung garment to be enveloped. The first station or starting station may be defined as a position at which the vacuum or gripping heads engage the leading portion of tubular material while the upper or second station is the point at which the garment is completely enveloped by the wrapping material. Such a component preferably includes a movable assembly reciprocating between the stations with appropriate control means for carrying out the various functions. Sealing means for the various forms of the wrapping material can be employed, which may be a part of the advancing assembly or alternatively separate components. Such sealing means preferably operate in conjunction with the gripping means.

The vertically oriented wrapping assembly of the present invention, in contrast to the horizontal arrangements of the prior art,

provide significant advantages for wrapping garments or other similar textile materials, which may be suspended by means of a hanger or the like. The presently vertically oriented wrapping apparatus provides a greater degree of control compared to horizontal apparatus which may require additional components or labour compared to the apparatus of this invention.

The wrapping assembly may also have means for temporarily suspending or mounting a commodity at the wrapping station and for transporting it for subsequent processing.

Such transport means or system advances the commodity between processing stations such as the wrapping and vacuum packaging stations and preferably comprises guide means extending between first and second processing stations, a pair of opposed gripping means movably mounted on said guide means, means for advancing said gripping means between said first and second processing stations, means for reciprocating each of said gripping means into and out of package engaging and package releasing positions at said first and second stations respectively, carrier means for supporting and suspending a commodity to be packaged, and means associated with said carrier means for disengaging a commodity from the carrier means.

In the transport system the guide means may be any suitable component, e.g., guide rods, etc., mounting the gripping means which preferably are in the form of gripping fingers engaging the interior of a bag with a suitable carriage or frame assembly being provided on which the gripping means are mounted and which carriage assembly goes between the respective processing stations. This may be a reciprocal type. The gripping means also includes a component for bringing such means into and out of package engaging and package releasing positions with the different components of the transport assembly being operated in time-related sequence. Means may also be provided for removing a hanger from the transportation system which may take the form of a pair of fingers or plates for engaging the hanger and displacing it upon actuation of e.g. a piston or the like.

The vacuum packaging assembly for vacuum packaging a textile product preferably is in the form of a device comprising a first surface, a second opposed flexible pressure-deformable surface mounted in operative relationship to said first surface with said first and second surfaces defining therebetween a commodity receiving area, said second member being deformable at least in said commodity receiving area, means for suspending said second pressure deformable surface in said spaced-apart

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relationship to said first surface, and means for creating a partial vacuum in said commodity receiving area to deform said second surface so that the central portion of said second surface is initially deformed in said commodity receiving area and subsequently outwardly therefrom whereby entrapment of air is minimized in packaging a commodity.

The vacuum packaging assembly may be provided with a pair of opposed flexible pressure-deformable surfaces - i.e. both of the above surfaces are flexible and deformable. At least one, or both, of the surfaces can be suspended in a spaced-apart relationship and the means for creating a partial vacuum to deform the pressure-deformable membrane can operate on one or both of such surfaces. Still further, an alternate embodiment of this invention of the vacuum packaging assembly utilizes a first rigid surface with the second opposed surface being pressure deformable but in place of vacuum creating means between the surfaces, pressure creating means can be applied to the face of the second surface opposite to the rigid surface opposite to the first surface whereby the application of pressure will achieve deformation of the deformable surface and compress a commodity from the central portion progressively outwardly. A still further modification of this embodiment is where both the first and second surfaces are pressure-deformable and both utilize means for applying pressure to the opposed outward faces to deform the respective surface into the commodity receiving area. Different pressures may be applied to one surface as opposed to the other depending on the type of commodity to be vacuum packaged. The first surface may be substantially rigid, with the second opposed surface being pressure-deformable, and with the combination of vacuum creating means for deforming the flexible surface into the commodity receiving area together with means for creating a pressure on the opposed face of the second surface so that the combination of vacuum creating means and applied pressure aid in increasing the speed of operation of the unit - or, in other cases, aid in compressing a commodity where greater pressures may be required other than those created by vacuum alone.

In the above arrangement, the flexible wall is a pressure-deformable one and by virtue of the suspending means and the spaced-apart manner of the opposed wall sections, the central portion of the flexible wall is capable of contacting the central portion of the commodity being vacuum packaged and then progressively going outwardly therefrom. It has been found that using this arrangement and as described in greater detail hereinafter vastly superior

results can be obtained as opposed to vacuum packaging using a rigid wall which compresses a commodity and exerts significant deleterious pressures on different portions of the packaged commodity.

For general purposes, either one or both of the above flexible and rigid walls may be movable into and out of engaging relationship. The rigid surface or wall may merely be a fixed plate rigidly secured to a suitable frame member. It may be made of any appropriate material for this purpose. On the other hand, the flexible air impermeable surface may be made of any material possessing the desired characteristics including air impermeable cloth, rubber, sheet plastic material or the like. Such material may be secured about its periphery to a suitable frame member with a sealing gasket or other like sealing structure being provided adjacent the edges of the flexible wall (or of the fixed wall) to define a vacuum chamber when the two walls are brought into operative spaced-apart relationship. The pair of walls forming the chamber are dimensioned so as to be substantially co-extensive at least in the area where the packaged garment is adapted to be contacted by the flexible wall.

A preferred vacuum chamber includes sealing means for sealing the top portion of the bag containing the commodity subsequent to the vacuum packaging step. Such sealing means are preferably mounted within the vacuum chamber and form a portion thereof. Sealing means, one mounted to each of the respective surfaces of the vacuum chamber, may be used with means for reciprocating one or both sealing heads into and out of sealing engagement with the packaging material. Any conventional means for creating a partial vacuum within the chamber may be used.

The vacuum packaging device may also include means for mounting a packaged commodity within the chamber - e.g. means associated with the transport system may be employed for this purpose. Thus, with the carrier means of the transport system which suspends or mounts a device of the type previously described using a heat sealable ligament, the packaged commodity may be aligned in the desired position within the vacuum chamber and the flexible ligament being located at least partially within the package so that upon actuation of the sealing means for the package within the vacuum chamber, the sealing means may seal the ligament. However, other conventional hangers may be employed as desired.

The above-described vacuum packaging assembly may be used in the vertical mode as described above or may be likewise used in a horizontal mode again for packaging different types of commodities. Thus it is immaterial whether the assembly is vertical-

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ly, horizontally or otherwise mounted.
An alternate form of the device also
includes an arrangement permitting one or
both of the surfaces or walls to be pivotally
mounted relative to each other permitting
one or both walls to be placed into operative
sealing engagement, either directly or
through frame members, using such a pivot-
ing arrangement.
10 The packaging material used to package
or envelop the commodities may be any
suitable flexible substantially air imperme-
able material for vacuum packaging pur-
poses. Such material are known in the art
and generally comprise single or multi-layer
plastic or plastic hybrids or even metallic
foils. These generally comprise the polyole-
fins (homo- or copolymer) - and laminates
of two or more extruded layers of the same
or different material. Specific plastic mate-
rials are e.g. polyamides, polyolefins e.g.
ethylene homo- and copolymers, propylene
homo- and copolymers, and more complex
polymers or copolymers, mixtures of these,
etc. Laminates using different properties of
two or more films are desirable packaging
material. Other materials include plastic
backed or coated (one or both sides) paper
materials, paper or plastic backed metallic
foils, e.g. aluminum foils. The choice of any
particular wrapping material will depend on
the particular type of properties desired.
20 Various types of commodities may be
packed by this invention. This invention
may be used particularly to package bulky
or voluminous products of natural or syn-
thetic origin e.g. textile materials such as
clothing, sheet material (e.g. bed cover-
ings), cushions, etc. - successful tests have
been made using overcoats, sweaters, shirts,
jackets, suits, etc.
30 In the drawings,
Figure 1 is a schematic overall view of the
apparatus,
45 Figure 2 is a section taken through the
conditioning tunnel,
Figure 3 is one embodiment of a garment
mounting device,
50 Figure 4 is an alternate garment hanger
version.
Figure 5 is a schematic view of the
wrapping and vacuum packaging units,
Figures 6A to 6G are schematic views of
the varying stages of operation of the
wrapping device,
55 Figure 7 is a schematic view of the lower
portion of the wrapping zone showing the
feeding system,
Figure 8 illustrates the cutting device,
60 Figure 9 illustrates the sealing head,
Figure 10 is a partial view of the device
system for the wrapping device,
Figure 11 is a partial detail view of the
cutting and sealing assembly,
65 Figure 12 is a schematic view of the

transport device;
Figure 13 is a side elevational view of
Figure 12;
Figure 14 is a cross-sectional view through
the sealing, cutting and vacuum device; 70
Figures 15A to 15C are side and front
elevational views showing the sequence of
operation and transferral of the wrapped
article;
75 Figure 16 is a perspective view of the
vacuum device;
Figure 17 is a top plan view of Figure 16;
Figures 18 and 19 are cross-sectional
views of the vacuum device, and
80 Figures 20 and 21 illustrate an article prior
to and after being vacuum wrapped.
Figure 1 illustrates the overall system and
has an initial conditioning section 20, a stabil-
izing section 22, a retention zone 24, a
wrapping station 26, a vacuum packaging
zone 28 and a discharge zone 30. A com-
modity to be wrapped, e.g. suits, is sus-
pended on appropriate hangers at a loading
station which has a continuous conveyor C
with flights 32, each engaging a hanger 34
suspending the article, which advance the
goods into the through the conditioning and
stabilizing zones.
95 The conditioning zone comprises a series
of stages or stations, one of which is
illustrated in Figure 2. Each station is a
portion of a tunnel defined by upper and
lower walls 36 and 38 joining a pair of
opposed side walls 40 and 42 to form an
enclosure. At each zone, an inlet 44 is
provided for introducing treated air sup-
plied from a main air system. The treated air
enters via a conduit 46 and exits via outlets
48 entering into a collector system 50 which
circulates it back to an air treatment device
52. This device conditions the air to provide
the requisite temperature and humidity.
Each zone or station is provided with inlets
44 and outlets 48 to provide a generally
balanced flow of air and to progressively
100 treat the articles to be packaged.
The conditioning system may include
e.g., two or three conditioning zones e.g. Z1
and Z2, etc. having the structure of Figure
2. The conveyor C transports the articles
115 into the open tunnel. Following the zone Z1
forming a portion of the conditioning zone,
the balance of the system through to the
storage area forms a conditioning zone in
which the treated and stabilized articles are
retained under generally stabilized tempera-
ture and relative humidity conditions. The
stabilizing system may include zones Z3
through Z5 each likewise being provided
with air inlets and discharge conduits as per
125 Figure 2 for providing the stabilizing condi-
tions.
The conditioning and stabilizing tunnels
may form a continuous closed system and
may be of various shapes e.g. an elongated 130

tunnel or as shown in the drawings, a "U-shaped" arrangement.

At the retention zone, the stabilized articles are maintained under the desired humidity and temperature conditions for subsequent wrapping and vacuum packaging. The conveyors discharge the articles from conveyor C by any suitable means onto a feeding line 54 where they are stored until required. Retention area 24 is provided with a pair of sliding doors 56 which operative with the wrapping station to permit a single article to be discharged when required. Suitable conventional means may be provided for advancing a treated article from the retention area to the wrapping station.

Figures 3 and 4 show two versions of suitable mounting means for articles such as clothing. Each includes a suitable "hanger" shaped body 60 for mounting clothing with, as per Figure 3, a wire or like member 62 projecting from the top. Hook 62 is connected to a further hook 64 engaging the conveyor system and a transport system. Hook members 62 and 64 are connected by a special ligament 66 comprised of a heat sealable, preferably flexible, material. This ligament is adapted to be sealed in and form a portion of the wrapped package. In Figure 4, the ligament is incorporated into a portion of the hanger 60 so as to provide direct mounting of the hanger 60 to the hook member 64 so that the ligament 66', passing through a slot 68, takes the place of the hook 62 in Figure 3.

Figure 5 et seq show the wrapping apparatus, the frame members are shown by reference letter F.

A material supply system for enveloping or wrapping a commodity comprises an "endless" synthetic plastic tube 70 mounted (rotatably) on a pair of drive rollers 72. Rollers 72 are mounted by means of shafts to frame F, each shaft having a gear 74. A motor 76 is provided with drive shaft 78 extending into a gear box 80 and which has an output gear 82. Drive belt 84 engages each gear 74 and 82 to rotate shafts 72 and thus drive the roll 70.

A guide shaft 86 is rotatably journaled in a pair of mounting brackets 88a over which the web W passes in the feeding direction. Fixedly secured to the shaft 86 is a pair of mounting brackets 90 (Figure 8) journaled a shaft 92 therebetween. Shaft 92 rotates about the axis of shaft 86. Mounted relative to the rotation of the shaft 92 is actuation means for the motor 76 e.g. micro-switch 94 so that rotation of shaft 92 by advancement of web W, shaft 92 or the mounting bracket 90 is effective to abut the microswitch 94 to initiate the drive of the motor 76 to rotate shaft 72 and advance a predetermined amount of material from roll 70.

Wrapping material W from the roll passes

under guide bar 98 journaled by frame members F and which position web W in vertical alignment for the wrapping operation.

The wrapping unit has a vertically movable web advancing, sealing and cutting assembly (Figure 5 et seq). Movable frame 100 is capable of being raised and lowered between first and second positions by a pneumatic cylinder system 102 which includes a connecting rod 104 secured to the frame member 100. Frame 100 is guided on opposed guide rods 106 by guide bushings 108. Frame member 110, at the rear of the wrapping unit, includes a rack and pinion drive system 112 with pinion 114 being rotatably journaled to frame 100 and in engagement with rack 116. Movement of frame 100 from the lower to upper position drives pinion 114. On shaft 118 for the pinion is a drive pulley 120 which rotates by the rotation of pinion 114 - it serves to drive feed rollers 122 by gear wheel 124 mounted on an extension of frame 100 and with each roller 122 being provided with shaft 126 having a drive wheel 128. Belt 130 extends about the drive wheels 124, 128, and 120, so movement of frame 100 in a vertical manner rotates the rollers 122.

A converging trough 134 aids in guiding an article to be wrapped and is located above rollers 122 with the converging mouth aligned with the top portions of rollers 122. Trough 134 is mounted by brackets 136 to frame 100.

Figure 11 shows frame 100 having pairs of mounting blocks 140 and 142 for mounting shafts 126 of rollers 122. Mounted on the frame is a pair (one being shown) of guide rods 144 journaled a sliding sealing and suction head. Shaft 144, journaled by bushings 146 to the frame 100, permits the vacuum and sealing head to reciprocate inwardly and outwardly by a pneumatic piston assembly 102 with a piston 150 with a rod 152. The reciprocating portion of the vacuum and sealing head has frame 154 journaled to rod 152 by clamp 156. Frame 154 has a vertical frame 158 (Figure 14) mounting vacuum and sealing members. There is provided, similarly, a fixed plate 162 on frame 100 and an upper sealing head 164 cooperating with opposed sealing head 166; in a like manner, lower vacuum chamber 168 cooperates with a movable vacuum chamber 170 associated with the movable assembly of Figure 11. The movable portion of the vacuum and sealing assembly is mounted on guide rods 144 by bushings 182 journaled on guides 144 so reciprocation of rod 152 causes movement between first and second positions.

The vacuum system (Figure 14) includes chambers 169 and 171 each connected to conduit 173 connected in turn to a vacuum

most position or first station upwardly (Figure 6C) to advance the wrapping tube upwardly about the garment. Rollers 122, rotated by the upward movement of the assembly of Figure 11, aid in placing the garment in the open-mouth endless tube. Figures 5, 10 and 14 illustrate a further aid for ensuring that the sleeves are placed within the trough and aligned for insertion into the tube; there may thus be employed a pair of conduits 191 at the ends of the trough 134 directing air jets onto the sides and including the sleeves of the garment.

As the assembly (Figure 11) advances vertically upwardly, microswitches or the like detect the movement and cause the rotation of the arms upwardly to their original position (Figure 6C). The assembly continues advancement to the uppermost position or second station (Figure 6D) where the tube extends beyond the garment. The fingers 338 of the transport system, previously brought into a "closed" position, are then actuated so they extend outwardly or laterally to engage the side edges of the wrapping tube (Figure 6E). The fingers then assume control of the tube with the garment therein, and the assembly commences downward movement.

Vacuum to the vacuum heads is cut when the fingers have assumed control of the wrapping tube to permit downward movement of the assembly.

When the assembly returns to the lowermost position, it severs and seals the lower portion of the endless tube to thereby form the bottom of a bag. The vacuum of the vacuum heads is re-established to engage the opposed walls of the continuous tube and subsequently, the heat sealing and severing operations are performed by reciprocation of piston 150 bringing sealing head 166 into engagement with sealing head 164 and by actuation of knife 172.

Subsequently, arm 181' is rotated 90° to the vertical behind the wrapping unit to permit the transport system to transport the wrapped or enveloped garment from the wrapping station to the vacuum packaging station (Figures 6F and 6G), with the wrapping station being ready to receive a further garment.

In Figures 5 and 16 to 19, the vacuum packaging system is illustrated with reference F designating frame members. Frame 300 is vertically mounted and as will be seen from Figure 16, the transport system delivers a suspended garment to the vacuum packaging station on guide rods 302. When the transport system is at the vacuum packaging station, the hanger 64 is transferred to a further hook 402 for positioning the garment at the vacuum packaging station, and the transport system returns to its initial station.

The vacuum packaging station has a non-flexible plate 404 secured to frame F forming one wall of a vacuum chamber. Wall 404 is non-movable and terminates at the upper position in a chamber 406. Operating with wall 404 is a further wall of flexible material mounted within a frame or housing 408, and which comprises side walls 410 defining an enclosure and extending to the top of the housing 406. Housing 408 includes a flexible layer of air impermeable material 412 essentially forming a flexible diaphragm and which is fixedly secured around its edges to the sides of chamber 408. As will be noted, the flexible surface 412 is spaced from the surface 404 and the two surfaces define therebetween a commodity receiving area where the packaged commodity is to be vacuum packaged. The periphery of surface 412 is mounted at a point spaced apart from surface 404 in such a manner that upon surface 412 being drawn inwardly by the creation of a vacuum, the central portion of the surface 412 is initially deformed in the area where the commodity is located and then subsequently outwardly therefrom. By mounting the peripheral edges of surface 412 in a manner spaced from surface 404, channels will be formed about the periphery of the surface, to reduce or prevent entrapment of air. Generally speaking, the degree to which the periphery of the flexible or pressure-deformable surface 412 is spaced from the surface 404 should be sufficient so that upon creation of a vacuum to the desired degree the deformable portion of the surface 412 is not higher than the highest portion of the commodity being vacuum packaged as this might otherwise prevent progressive outward deformation of the surface 412. To this end, the periphery of the deformable surface 412 is mounted by suitable means and is shown in Figure 18. Suitable means to secure it to the peripheral portions of the housing 408 may be employed. Alternately, an adjustable means may be provided for varying the distance to and from the surface 404 for packaging different types of commodities. Air communication is provided between the outer side of flexible layer 412 and the back wall of the chamber 408 - in an alternate form there need not be provided a rear or side walls and instead a frame may merely mounted the flexible sheet 412.

Housing 408 is provided with a sealing gasket 415 to form a vacuum chamber, in conjunction with the flexible wall 412, and the rigid wall 414, when the two walls are brought into operative relationship with each other. Wall assembly 408 is movable on frame F for reciprocating into and out of operative engagement with wall 404; flanges 414 are slidably journaled on guide rods 416 by bushings and a piston assembly 418 is

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provided with piston rod 420 secured to the assembly 408. Actuation of piston 418 brings the flexible wall into and out of engagement with the rigid wall 404.

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Within the vacuum chamber are a pair of cooperating sealing heads one associated with wall 404 and the other with movable wall assembly 408. Both are secured by brackets 422; however, in the case of one of the sealing heads 420, it is mounted by bracket 424 to piston rod 426 of piston 428 to bring it into and out of engagement with the opposed sealing head. Sealing heads 420 are similar to those described previously.

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A pair of spring loaded clamps 430 and 432 journaled by brackets 434 are adapted to position the package to be sealed. One or both of these clamps are provided with spaced-apart passages 440 (Figures 17, 19) to permit air to be drawn from the chamber formed by the cooperating wall surfaces in which the package is located. A vacuum source (not shown) is connected to conduit 442 leading to chamber 406, and creates a partial vacuum in the enclosure formed between the cooperating walls 404 and 412.

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The above-described arrangement provides a vacuum packaging system in which the flexible wall is initially drawn against the central portion or area of the garment to be vacuum wrapped upon creation of a vacuum in the chamber. Thus, inward movement of the flexible wall 412 initially contacts the central area or portion of the wrapped garment due to the fact that the peripheral portions of the flexible wall 412 are mounted above the commodity and in a manner spaced from the surface 404. Thus, even when the membrane 412 is collapsed due to a high vacuum against the commodity being treated and the surface 404, the normal resistance to bending or deformation at right angles (as opposed to less acute bending) will leave channels about the side walls of the housing. Upon suction being further applied, and as outlined above, the flexible wall progressively contacts the commodity from the central area outwardly with the result that entrapment of air is minimized or eliminated from the packaged commodity. Due to this, there is provided a significant improvement in the vacuum packaging of commodities compared to the use of solid plates or the like proposed by the prior art for compressing and vacuum packaging commodities. Still further it will be appreciated that by using a flexible or deformable membrane, substantially equal pressure is applied to the commodity throughout all portions of the commodity by creation of the vacuum and again, this avoids the deleterious effects of using a substantially flat plate or the like to compress and vacuum package a commodity where significant pressures would be ap-

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plied to any irregularly shaped portion of a commodity. This feature provides many desirable attributes to the vacuum packaging operation.

During the sealing operation, the heat-sealable ligament 66 is sealed and forms a portion of the seal about the package to permit an airtight enclosure to be formed. However, if desired, conventional hangers of metal or the like may be employed by using flexible sealing heads to tightly seal the bag about the metal hanger.

An improved vacuum packaging assembly comprises the above arrangement but utilizes on the outer face of deformable membrane 412 pressure creating means in place of the vacuum creating means whereby the means for creating a partial vacuum may be eliminated. Alternately, such pressure creating means to aid in the deformation of the membrane 412 may be employed in conjunction with the means for creating a partial vacuum. Likewise, a further embodiment utilizes a pair of flexible membranes whereby the rigid wall 404 may be dispensed with and a membrane similar to membrane 412 may be employed in its place. If desired membrane 404 may likewise be suspended in a manner similar to membrane 412 although it is only necessary that one such membrane be so mounted as shown in Figure 18. Where two flexible deformable membranes are employed, both may be operated by means of pressure creating means (using air pressure introduced into an enclosed chamber behind the respective membranes). In some cases, it may be desirable to combine such an arrangement with vacuum means as described with respect to Figure, 18 to aid in the vacuum packaging operation.

The transfer sequence (Figures 15A to 15C) for the sealed vacuum packaged garment employs a carrying hook 352 associated with the transport device, which in turn carries spaced-apart rollers 33 with a depending hook 35 mounting the hanger 64. It operates as follows: hook 402, rotatably driven by motor 460, is positioned in alignment with hook 352 where the transport system arrives at the vacuum packaging unit upon reciprocation of the former. Movable fingers 354 (Figures 12 and 13), mounted on a pivot point 356, are free to rotate about a horizontal axis so fingers 354, upon actuation, engage a respective one of the pulleys 33 to advance them onto hook 402. The fingers may be conventionally actuated by e.g. a piston mounting a piston rod 462. Finger 462 abuts the fingers 354 to pivot the same and push the wheels with its attendant hooks onto the hook 402.

Hook 402, mounted at a slight angle for the vertical is capable of pivoting about its axis 90° by motor 460. Take-off rod 464

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receives the wrapped vacuum packaged goods following completion of the vacuum packaging and once the operation has been completed, motor 460 is actuated to rotate the hook 402 90° to place the rollers 33 in a position to engage the rod 464. Thus, upon rotation (Figure 15C) the terminal portion of the hook no longer functions to retain rollers 33 and they slide off onto rod 464. Rod 464 delivers the wrapped goods to storage area 480 which may comprise a plurality of rods 482 associated with the rod 464.

Figures 20 and 21 illustrate a cushion which may be wrapped and vacuum packaged. The cushion has a covering enveloping a compressible foam core and which may typically have a dimension of e.g. .5 - 1 meter in width and length and a height of e.g. .25 - .3 metres. Figure 21 illustrates the same product after processing with the width and length of the compressed product being substantially similar to that of the unpackaged product but the height has been compressed to approximately one fifth of the size.

All of the components of the system described herein may be operated in time-related sequence with conventional control means well known to those skilled in the art. Thus, the function of each component may be operated in a time-related sequence to other components with the whole assembly being controlled by an appropriate control system. As indicated, such systems are well known to those skilled in the art and no detailed explanation is required.

The following example following the teachings of copending United Kingdom application Number 45383/77 (Serial No. 1597243) will serve to illustrate the various aspects of the apparatus of Figures 1 - 21.

The apparatus previously described was employed in which the conditioning system contained two zones - i.e., the treatment zone and the stabilization zone. Each zone is provided with a plurality of air ducts located at the top of the tunnel and with a corresponding number of circulation fans at the bottom, and with air inlets being provided.

Conditioning air was provided for by passing a mixture of ambient air from outside the tunnel and air in the tunnel through dehumidifying and cooling machines to provide conditioning air. The conditioning air provided for the stages of the treatment tunnel range from 30 - 20°C. and 30 - 15% relative humidity; and in the different stages of the stabilization zone, 20°C - 15°C and 12% - 5% relative humidity. Control means for introducing the conditioned air were provided to obtain a balanced air flow in each zone and preferably in each stage of each zone.

Samples of men's suits of 100% wool,

were introduced into the conditioning system at the inlet port. The ambient atmospheric conditions were approximately 30°C and 60% relative humidity. The system was set for an operational time limit, from entering the treatment tunnel to the discharge, of approximately 60 minutes. The initial treatment stages were set in operation with conditioned air being introduced at a rate of 400 liters per second. In the stabilization zone, conditioned air was introduced at about 200 liters per second with air temperatures in the initial portion of the treatment zone being about 30°C. and in the later stage of the treatment zone approximately 20 - 15°C. The air temperature in the stabilization zone was maintained at a constant 15 - 20°C.

The garments were subjected to treatment using the conditioned air to dehumidify and condition the garments for a period of approximately 30 minutes. It was found, after running the system, that as a result of the conditioned air being introduced, and the mixture of conditioned air and ambient air, a mixture was obtained in which the relative humidity varied from approximately 30% at the initial stage of the treatment zone to approximately 15% at the end or latter stage of the treatment zone. In the stabilization zone, the relative humidity was maintained at a constant 10%.

The length of the treatment zone was 10 meters with a height of 2 meters and a width of 80 centimeters. The stabilization zone had a length of 10 meters with air being removed at 480 liters per second (with a total of 1200 cubic meters per hour being removed from both zones).

Upon exiting from the stabilization zone, the garments were tested and found to contain a moisture regain corresponding to equilibrium in air, of 10 - 12% relative humidity, and 20°C. These garments were subsequently wrapped and vacuum packaged using the apparatus described above. Packaging reduced the volume of the garments, depending on the type of garment, to between 1/3 - 1/2 of their original volume. The garments were stored for 1 week and the vacuum packaging removed. Such garments were found to be substantially free from wrinkles and in a totally acceptable commercial condition.

If desired, following removal of the vacuum packaging from the garment, the product may be reconditioned by exposing the same to relative humidities of 50% or greater and temperature conditions of 20 - 45°C. In effect, this reconditioning step speeds the recovery of the garment from its compressed state to its normal original condition without having to wait for longer periods of time.

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above-described apparatus without depart-
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ated. Thus, for example, the vacuum may
be withdrawn at any desired location from
the chamber and rather than as illustrated,
from both ends or through the fixed wall
provided it is not in the area where the
commodity is packaged, etc.

WHAT WE CLAIM IS:-

1. An apparatus for wrapping the
vacuum packaging a commodity comprising
supply means for supplying a length of
wrapping material, means for supplying a
commodity, means for enveloping said com-
modity in said wrapping material, first and
second opposed surfaces mounted in
opposed relationship and defining therebe-
tween a commodity receiving area, said first
surface being deformable in said commodity
receiving area, means for supporting said
first surface in a spaced-apart relationship
relative to said other surface, means for
causing said first surface to be brought into
contact with said commodity in said com-
modity receiving area whereby said first
surface is initially deformed in said com-
modity receiving area and subsequently
outwardly therefrom to reduce entrapment
of air in packaging the commodity.

2. An apparatus as claimed in claim 1
wherein the second surface is a rigid surface,
said opposed flexible pressure-deformable
first surface being mounted in operative
relationship to said second surface with said
first and second surfaces defining therebe-
tween the commodity receiving area, and
means for applying pressure to said pressure
deformable surface exteriorly thereof to
deform said first surface in said commodity
receiving area so that the central portion of
said first surface is initially deformed in said
commodity receiving area and subsequently
outwardly therefrom, whereby entrapment
of air is reduced in packaging a commodity.

3. An apparatus as claimed in claim 2
further including a transport device for
advancing and controlling the commodity
between wrapping and vacuum packaging
means comprising guide means extending
between said stations, a pair of opposed
gripping means movably mounted on said
guide means, means for advancing said
gripping means between said stations,
means for reciprocating each of said grip-
ping means into and out of package engag-
ing and package releasing positions at each
of said stations, carrier means for support-
ing and suspending the commodity to be
packaged, and means associated with said
carrier means for disengaging the commodi-
ty from the carrier means.

4. An apparatus as claimed in claim 1, 2
or 3 wherein the wrapping means comprises
a wrapping assembly having supply means
for supplying a length of wrapping material

having opposed wall sections, means for
engaging and maintaining the opposed wall
sections of the leading portion of said
wrapping material in a spaced-apart manner
to form a commodity-receiving space,
means for vertically advancing said wrap-
ping material with said walls in a spaced-
apart manner from a first vertical position to
a second terminal vertical position in a
predetermined path, means for vertically
mounting a commodity to be enveloped by
said wrapping material in said predeter-
mined path whereby when said advancing
means vertically advances said material
from said first position to said second
position, said commodity is enveloped by
said material as said material advances
between said vertical positions.

5. An apparatus as claimed in claim 1
wherein both said first and second surfaces
are flexible pressure deformable surfaces
with at least one of said surfaces being
suspended in an opposed relationship to
define a spaced-apart area between said
surfaces to receive a packaged commodity.

6. An apparatus as claimed in claim 1, 2
or 3, wherein said apparatus includes means
for creating a partial vacuum in said com-
modity receiving area between said first and
second surfaces and operating in conjunc-
tion with said means for applying pressure
exteriorly of said second surface.

7. An apparatus as claimed in claim 1 or
6, wherein said surfaces are enclosed and
suspended relative to each other in a hous-
ing, a pressurizable chamber behind each
surface, and means for pressurizing each
chamber to cause said surfaces to deform
towards each other initially in said commodi-
ty receiving area.

8. An apparatus for wrapping and
vacuum packaging a commodity as defined
in claim 1, 2 or 3, including means for
suspending said pressure deformable sur-
face in a spaced-apart relationship to the
other surface, and means for creating at
least a partial vacuum in said commodity
receiving area to deform said pressure de-
formable surface.

9. An apparatus as claimed in claim 3
having means for transporting an enveloped
commodity between said wrapping assembly
and said vacuum packaging assembly.

10. An apparatus as claimed in claim 3,
wherein said wrapping means and said
vacuum packaging means are located at
spaced-apart stations, said transport device
being adapted to engage and control a
packaged commodity between wrapping
and vacuum packaging assemblies, said
transport device comprising guide means
between said wrapping and said vacuum
packaging assemblies, a pair of opposed
gripping means movably mounted on said
guide means and adapted to engage



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above-described apparatus without departing from the invention as will be appreciated. Thus, for example, the vacuum may be withdrawn at any desired location from the chamber and rather than as illustrated, from both ends or through the fixed wall provided it is not in the area where the commodity is packaged, etc.

WHAT WE CLAIM IS:-

1. An apparatus for wrapping the vacuum packaging a commodity comprising supply means for supplying a length of wrapping material, means for supplying a commodity, means for enveloping said commodity in said wrapping material, first and second opposed surfaces mounted in opposed relationship and defining therebetween a commodity receiving area, said first surface being deformable in said commodity receiving area, means for supporting said first surface in a spaced-apart relationship relative to said other surface, means for causing said first surface to be brought into contact with said commodity in said commodity receiving area whereby said first surface is initially deformed in said commodity receiving area and subsequently outwardly therefrom to reduce entrapment of air in packaging the commodity.

2. An apparatus as claimed in claim 1 wherein the second surface is a rigid surface, said opposed flexible pressure-deformable first surface being mounted in operative relationship to said second surface with said first and second surfaces defining therebetween the commodity receiving area, and means for applying pressure to said pressure deformable surface exteriorly thereof to deform said first surface in said commodity receiving area so that the central portion of said first surface is initially deformed in said commodity receiving area and subsequently outwardly therefrom, whereby entrapment of air is reduced in packaging a commodity.

3. An apparatus as claimed in claim 2 further including a transport device for advancing and controlling the commodity between wrapping and vacuum packaging means comprising guide means extending between said stations, a pair of opposed gripping means movably mounted on said guide means, means for advancing said gripping means between said stations, means for reciprocating each of said gripping means into and out of package engaging and package releasing positions at each of said stations, carrier means for supporting and suspending the commodity to be packaged, and means associated with said carrier means for disengaging the commodity from the carrier means.

4. An apparatus as claimed in claim 1, 2 or 3 wherein the wrapping means comprises a wrapping assembly having supply means for supplying a length of wrapping material

having opposed wall sections, means for engaging and maintaining the opposed wall sections of the leading portion of said wrapping material in a spaced-apart manner to form a commodity-receiving space, means for vertically advancing said wrapping material with said walls in a spaced-apart manner from a first vertical position to a second terminal vertical position in a predetermined path, means for vertically mounting a commodity to be enveloped by said wrapping material in said predetermined path whereby when said advancing means vertically advances said material from said first position to said second position, said commodity is enveloped by said material as said material advances between said vertical positions.

5. An apparatus as claimed in claim 1 wherein both said first and second surfaces are flexible pressure deformable surfaces with at least one of said surfaces being suspended in an opposed relationship to define a spaced-apart area between said surfaces to receive a packaged commodity.

6. An apparatus as claimed in claim 1, 2 or 3, wherein said apparatus includes means for creating a partial vacuum in said commodity receiving area between said first and second surfaces and operating in conjunction with said means for applying pressure exteriorly of said second surface.

7. An apparatus as claimed in claim 1 or 6, wherein said surfaces are enclosed and suspended relative to each other in a housing, a pressurizable chamber behind each surface, and means for pressurizing each chamber to cause said surfaces to deform towards each other initially in said commodity receiving area.

8. An apparatus for wrapping and vacuum packaging a commodity as defined in claim 1, 2 or 3, including means for suspending said pressure deformable surface in a spaced-apart relationship to the other surface, and means for creating at least a partial vacuum in said commodity receiving area to deform said pressure deformable surface.

9. An apparatus as claimed in claim 3 having means for transporting an enveloped commodity between said wrapping assembly and said vacuum packaging assembly.

10. An apparatus as claimed in claim 3, wherein said wrapping means and said vacuum packaging means are located at spaced-apart stations, said transport device being adapted to engage and control a packaged commodity between wrapping and vacuum packaging assemblies, said transport device comprising guide means between said wrapping and said vacuum packaging assemblies, a pair of opposed gripping means movably mounted on said guide means and adapted to engage

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opposed wall sections of a package at said second position, means for advancing said spaced-apart gripping means between said wrapping and said vacuum packaging assemblies, and means for reciprocating gripping means into and out of package-engaging and package-releasing positions at said first and second stations whereby said gripping means is adapted to engage a package at said wrapping assembly and disengage from said package at said vacuum packaging assembly.

11. An apparatus as claimed in claim 2 wherein at least one of said surfaces is mounted in a movable housing and wherein said vacuum packaging includes means for bringing said housing into and out of sealing engagement with the other of said surfaces by advancing said housing into operative relationship with said other surface, said other of said surfaces being mounted in a fixed relationship to said movable surface.

12. An apparatus as claimed in claim 11 wherein said means for bringing said housing into sealing engagement comprises means for pivoting said housing about a fixed point.

13. An apparatus as claimed in claim 2 including a conditioning apparatus suitable for conditioning a fibrous material having an elongated chamber with a treatment zone and stabilizing zone, said chamber being enclosed in said zone with said zones being in communication with each other, said chamber having a loading and receiving port in communication with said treatment zone for receiving a commodity to be conditioned, and a discharge port for discharging a conditioned commodity, said discharge port being in communication with said stabilizing zone, conveying means in said chamber for receiving a commodity at said loading and receiving port and for transporting said commodity between said loading and receiving ports to said treatment and stabilizing zones and to said discharge port, means for providing a source of conditioning air, means for introducing a flow of said conditioning air into said treatment zone, means for introducing a flow of said air into said stabilizing zone, and means for removing from said treatment and said stabilizing zone spent conditioning air.

14. An apparatus as claimed in claim 13 wherein there is included a retention chamber associated with said discharge port whereby conditioned garments may be retained in said retention chamber after being discharged from said conveying means.

15. An apparatus as claimed in claim 13 wherein said means for providing a source of conditioning air provides a mixture of ambient air and conditioned air.

16. An apparatus as claimed in claim 2 including a mounting and suspending device

suitable for mounting and suspending a commodity to be wrapped or packaged with said device adapted to be partially sealed into and form a portion of a wrapped packaged commodity, said device comprising a body portion for mounting or suspending a commodity, and a hook portion for suspending the wrapped packaged commodity from a carrier or the like and a thin, flexible heat sealable ligament connecting said body portion and said hook portion.

17. An apparatus as claimed in claim 16 in which said mounting and suspending device has a hanger-shaped body portion which is adapted to retain a garment such as a coat or the like, said ligament being connected to said body portion at one end thereof and to said hook portion at the other end thereof.

18. An apparatus as claimed in claim 16 wherein said body portion in the mounting and suspending device comprises a hanger-shaped body portion adapted to retain a garment such as a coat or the like, hook extending from said body portion, a ligament connected to said hook at one end thereof and a hook connected to the other end of said ligament.

19. An apparatus as claimed in claim 16 wherein said ligament in said mounting and suspending device comprises an endless ligament secured at one end thereof to said hanger shaped body portion and secured at the other end thereof to said hook portion.

20. A method of vertically wrapping and subsequently vacuum packaging of a commodity in a flexible airtight package by an apparatus as claimed in any preceding claim comprising the steps of supplying a length of flexible air impermeable wrapping material, vertically advancing said material in a predetermined fixed path from a first vertical station to a second vertical station, vertically positioning a commodity to be wrapped in the direction of vertical advancement of said material between said first and second vertical stations and in said fixed path, vertically enveloping said commodity with said material as said material advances from said first vertical station to said second vertical station to enclose said commodity within said material, and subjecting said enveloped commodity to a vacuum packaging step in which said commodity is initially compressed centrally and thereafter progressively outwardly.

21. A method as defined in claim 20 wherein said commodity has been subjected to a conditioning step prior to enveloping in said wrapping material.



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22. An apparatus for wrapping and vacuum packaging a commodity as claimed in claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

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PATENTS ACT 1949

SPECIFICATION NO 1597242

Amendment is made in accordance with the Decision of the Examiner acting for the Comptroller-General, dated the 3 day of February 1982 under Section 9 in the following manner:—

Reference has been directed in pursuance of Section 9 subsection (1) of the Patents Act, 1949 to Patent No 1544261.

THE PATENT OFFICE
5 March 1982

Bas 88798/2

PATENTS ACT 1949

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