April 23, 1968 S. D. DENKER 3,378,989

PACKAGING MACHINERY

Filed Feb. 24, 1965 2 Sheets-Sheet 1

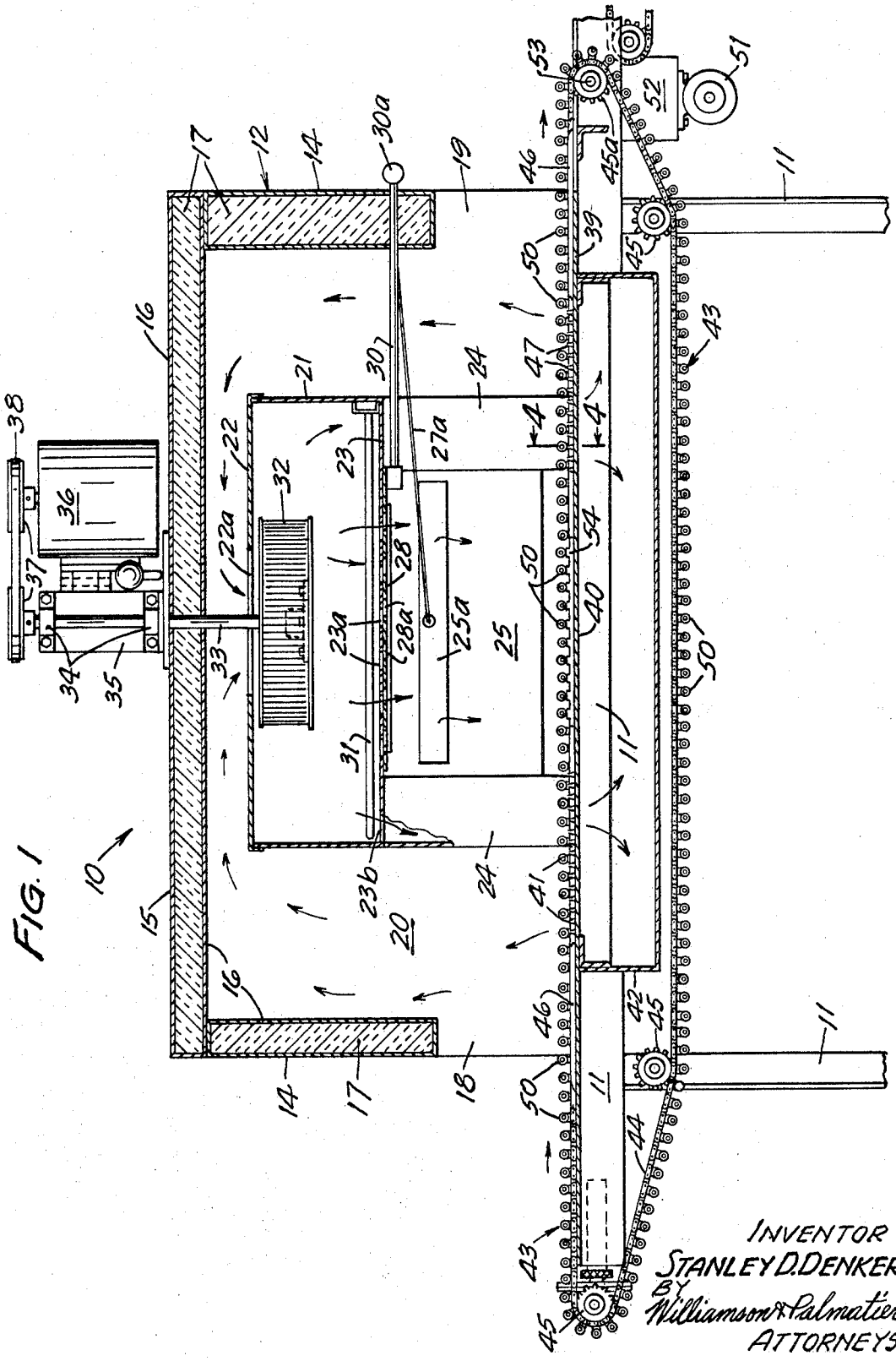

FIG. 1

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FIG. 2

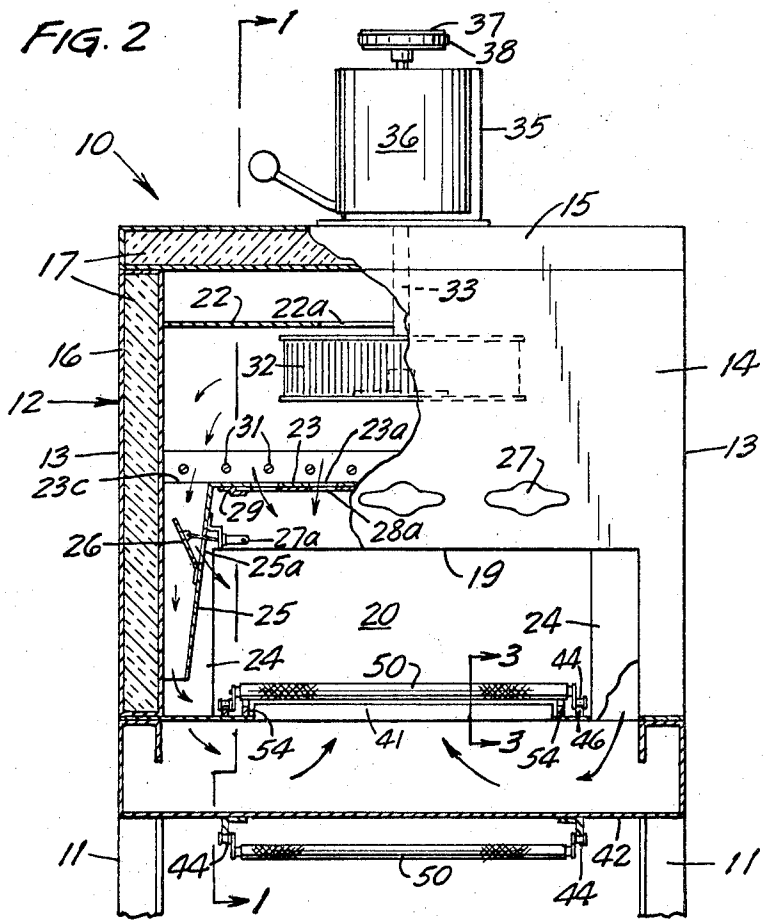


FIG. 3

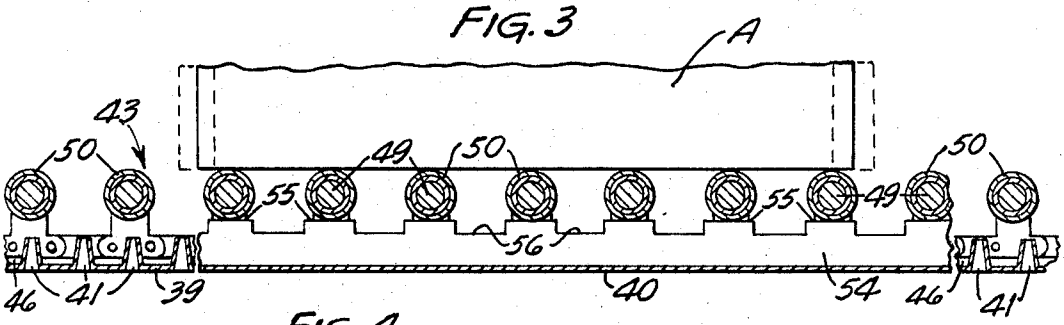
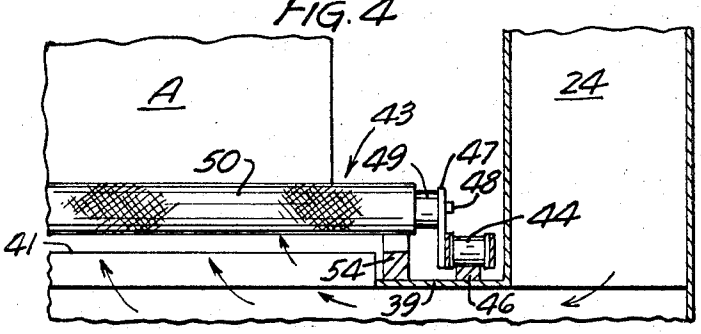


FIG. 4



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PACKAGING MACHINERY

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ABSTRACT OF THE DISCLOSURE

A shrink tunnel including a hood with open end walls through which a conveyor extends in overlying relation with an air plenum directing air upwardly through ports in the top of the plenum into the interior of the hood; the conveyor comprising widely spaced rollers moving around an endless path; there being notched bars over which the rollers ride and are revolved within the hood, the rollers remaining stationary as they pass over the notches.

Although such film shrinking apparatus have been previously known, difficulty has been experienced in producing substantially uniform shrinking of all sides of the package. Although flow of air around the package has been induced and controlled previously, desired results of uniform shrinking have not been obtained.

An object of my invention is to provide a new and improved apparatus of simple and inexpensive construction and operation for producing shrinking of film packages into close fitting relation with the article packaged.

Another object of my invention is to provide a novel apparatus for effecting substantially uniform shrinking of substantially all portions of thermoplastic sheet material packages to thereby prevent distortion of such packages in relation to the articles being packaged.

Still another object of my invention is to provide an improved and novel apparatus for preventing distortion of thermoplastic film or sheet material packages being shrunk by reason of lack of exposure of all portions of the package to shrinking heat.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a longitudinal section taken through the machine at approximately 1—1 in FIG. 2;

FIG. 2 is an end elevation view, shown partly in section for clarity of detail;

FIG. 3 is an enlarged detail section view taken substantially at 3—3 in FIG. 2 and illustrating a packaged article being carried through the heated enclosure for shrinking the package; and

FIG. 4 is an enlarged detailed section view.

One form of the invention is shown in the drawings and is described herein. The apparatus for shrinking the thermoplastic sheet material package into close fitting relation with the packaged article as indicated in general by numeral 10 and includes a frame 11 which includes various upright and horizontal rigid frame members supporting the remainder of the apparatus and housings described herein.

The apparatus 10 is provided with an enclosure 12 having sidewalls 13, endwalls 14 and a top 15, all of which are constructed of sheet metal 16 formed into a generally hollow panel and filled with insulation 17. The endwalls of the enclosure are provided with entrance and exit ports 18 and 19 respectively providing access into the open interior or chamber 20 defined within the enclosure 12.

The enclosure 12 is provided with means for heating and circulating heated air in the open interior 20 and such means includes a sheet metal housing 21 having a top wall 22 with an air inlet opening 22*a* therein, a bottom wall 23 with a plurality of airflow regulating ports 23*a* therein and also having conduit supplying air ports 23*b* in the corner locations of the housing 21 for directing heated air therefrom downwardly into the sheet metal conduits 24, hereinafter more fully described; and the bottom panel 23 also has side ports 23*c* supplying heated air downwardly behind the air directing panels 25 which are affixed to the opposite sidewalls 13 of the enclosure for conveying air downwardly adjacent the lower portion of the enclosure. These panels 25 have damper gates 26 for regulating the airflow through openings 25*a* in the panels 25. The position of the damper panels 26 may be individually controlled as by operating handles 27 which are connected to the panels as by cables 27*a*. A slide gate 28 underlies the bottom panel 23 and is provided with a plurality of ports or openings 28*a* therein which may be aligned with or moved out of alignment with the ports 23*a* in the bottom panel 23, depending upon the longitudinal position of the gate panel 28. It will be seen that the panel 28 is slidably mounted in clips or tracks 29 affixed as by spot welding to the bottom panel 23. The position of the panel 28 may be controlled by the operating handle 30*a* which is connected thereto as by rod 30.

Electric heating elements or coils 31 are mounted within the housing 21 for heating the air circulating therethrough.

An air moving fan 32 is rotatably mounted within the housing 21 on a shaft or spindle 33 which extends downwardly through the opening 22*a* and through the top wall 15 from the bearings 34 affixed on the base plate 35 on the top 15 of the enclosure 12. The shaft 33 is driven from a motor 36 by pulleys 37 and belt 38.

The enclosure 12 also has a bottom panel 39 affixed to the frame 11 and defining an imperforate central deck portion 40 beneath the central portion of housing 21, and also defining a plurality of elongate slots or air ports 41 adjacent the opposite ends of the open interior 20 of the enclosure and permitting airflow upwardly therethrough. The bottom panel 39 defines the top of a sheet metal plenum 42 which underlies the bottom panel 39 and communicates with the lower ends of conduits 24 to be supplied with heated air from the housing 21 so as to direct air upwardly through the air slots or discharge ports 41.

Means are provided for carrying articles confined within thermoplastic sheet material or film packages through the enclosure 12 so as to expose the thermoplastic packages to the substantial heat within the open interior 20 and thereby effect shrinking of the thermoplastic material into close fitting relation with the packaged article, and such conveying means comprises an elongate continuous conveyor, indicated in general by numeral 43 and including roller chains 44 trained around sprockets 45 with one run of the chains and conveyor 43 extending in overlying relation with the bottom panel 39 of the enclosure. The bottom panel 39 has roller chain supporting tracks 46 affixed thereto and supporting the roller chains 44. The roller chains are provided with a plurality of upstanding rigid plates or ears 47. The ears 47 are provided with bearing apertures in which the end portions 48 of elongate rod-type rollers 49 are journalled. It will be seen that the rollers 49 extend transversely of the chains 44 and actually carry the packaged article A, seen in FIG. 3 through the enclosure 12.

Each of the rollers 49 is provided with a wrapping 50 of loosely woven fabric material such as asbestos to prevent the packaged article A from actually engaging

the peripheries of the rollers and for allowing some air circulation to the thermoplastic material engaged with the fabric cover. The fabric cover prevents concentrating of heat at any particular portion of the thermoplastic film material in the packaged article A and thereby prevents any portion of the thermoplastic film material from sticking to the conveyor or any of the rollers. Means are provided for moving the conveyor **43** about its endless path of travel, and in the form shown, a motor **51** is suspended from the frame structure and is connected through a speed reducing gear box **52** to the shaft **53** of the drive sprockets *45a*.

Means are provided for revolving the rollers **49** within the open interior **20** of the enclosure so as to effect progressive movement of the packaged article A along the conveyor **43** so as to change the location at which the rollers and their fabric covers engage the packaged article and thereby expose all of the surface area of the thermoplastic material to the heated circulating air within the enclosure. In the form shown, the means for revolving the rollers **49** comprise elongate rigid bars **54** affixed on the deck portion **40** of the bottom panel **39** adjacent the opposite ends of the rollers **49** so that the upper edges **55** of the bars engage the fabric covers **50** on the rollers as the rollers **49** are drawn through the enclosure by the chain **44**. As the fabric covered rollers **49** move over the upper edge of the bar **54**, the rollers revolve. It will be seen that the bars **54** are provided with a plurality of notches **56** in their upper edges so as to define a plurality of substantially square corners in said bars **54**. As the rollers **49** pass over the notches **56**, no further rotating of the rollers is effective, but as soon as each roller engages the next adjacent portion of the upper edge **55**, the roller is revolved through a small arc again.

As a result of the progressive movement of the packaged article A along the conveyor **43** as the article A is carried by the conveyor through the enclosure **12**, all portions of the thermoplastic film or sheet material comprising the package for the packaged article A are substantially uniformly exposed to the heated circulating air in the open interior **20** so that the thermoplastic film material is uniformly shrunk throughout its entire area, thereby minimizing any distortion in the package as it is shrunk into conformity to the shape of the article.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. Apparatus for shrinking a thermoplastic sheet material package into close fitting relation with the packaged article comprising a frame,

an enclosure on the frame and having an open interior facilitating circulation of heated air about the packaged article, said enclosure having a bottom and having sidewalls with entrance and exit ports therein providing access to the open interior,

air heating and circulating means directing heated air in the open interior of the enclosure and about a packaged article therein,

an elongate endless packaged article conveyor extending through the open interior of said enclosure and through said entrance and exit ports and moving such packaged articles into and out of the circulating heated air in said open interior of the enclosure, said endless conveyor including a pair of spaced and parallel elongated flexible endless conveyor elements,

a plurality of elongate rollers extending transversely between said conveyor elements and having opposite ends respectively journaled on said conveyor elements, said elongate rollers having looselly woven fabric wrapped on the peripheries thereof and maintaining the rollers in spaced relation with the packaged articles supported and rolled along said rollers,

and means for revolving said rollers in said open interior and producing progressive movement of the packaged articles along the conveyor for exposing all portions of the thermoplastic package to the heated circulating air within said enclosure and thereby effecting uniform shrinking of the package, said roller revolving means including a stationary bar on the bottom of said open interior and underlying said rollers, said bar extending along the conveyor and having an upper roller-engaging edge portion effecting rotating of the rollers rolled therealong, said edge portion having notches therein over which the rollers may pass without being revolved.

2. The thermoplastic sheet material package shrinking apparatus according to claim **1** wherein said rollers are regularly spaced along said conveyor elements, the notches in said bar being regularly spaced from each other by distances equaling the regular spacing between said rollers and thereby produce rotating of a number of said rollers at the same time to effect movement of the packaged article along the conveyor and thereby expose all portions of the thermoplastic package to the heated air for producing uniform shrinking of the plastic film material.

3. An apparatus shrinking a package wrapper into conformity with the exterior configuration of an object therein, comprising a frame,

elongate means on the frame supporting and conveying a wrapped package in a predetermined direction and including an elongate endless package conveyor having a plurality of transversely extending widely spaced rigid support elements for carrying a package thereon and said widely spaced support elements permitting air to circulate and impinge against the package wrapper supported thereon, said conveyor having a package carrying run and also having a return run spaced below said package carrying run,

an enclosure on the frame and having an open interior facilitating circulation of heated air about the packaged article, said enclosure having side wall port means providing access to the open interior and receiving said package carrying run of the conveyor therethrough,

an air heating and circulating means directing air into the open interior of the enclosure at about a packaged article on the conveyor therein, said air circulating means including a plenum disposed between the package carrying run and the return run of said conveyor and underlying the open interior of said enclosure, the plenum having a top wall defining the bottom of said enclosure and lying next adjacent beneath the package carrying run of said conveyor, said top wall having a plurality of air directing and discharge ports underlying the package carrying run of the conveyor and directing air upwardly into said open interior and between said support elements to cause the heated air to impinge against the package wrapper and produce shrinking of the wrapper.

4. The package wrapper shrinking apparatus according to claim **3** and wherein said air discharge ports in the top wall of the plenum are located along a substantial portion of the package carrying run of said conveyor to direct air against the wrapper of the package at multiple locations as the package is carried through the enclosure by the conveyor,

and means repositioning the wrapped package on the conveyor and with respect to said support elements and facilitating exposure of all portions of the bottom of the package to impingement by the upwardly directed heated air from said air discharge ports for effecting shrinkage of the wrapper.

5. The package wrapper shrinking apparatus according to claim **3** and wherein said air discharge ports are located along a substantial length of the package carrying run of the conveyor,

and said air heating and circulating means including air flow direction control means proportioning the air

directed into said plenum and thereby controlling the volume of air discharged from said air ports and the force with which the air impinges against the package wrapper.

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