Two series of endless chains each comprising a plurality of traylike open half-shells pivotally interconnected at their ends are arranged in close proximity to each other so that the working reaches of the chains are parallel and so that the open shells of one chain are disposed in opposed relation to the open shells of the other chain to form a series of cavities along the working reaches of the chains. A strip of heat sealable shrink film is disposed along and held against the open faces of the half shells of each of the chains by articulated force applying structure arranged to impart uniform force thereto and vacuum means is employed to draw the film into lining relation with each of the half shells. An assembly of items to be packaged is inserted into the space between two opposed half-shells adjacent the entry end of the working reaches of both chains. After the half-shells of one reach come into biased engagement with the open half-shells of the other reach to envelope as assembly of items to be packaged, a jet of heated air is applied along the top and bottom edges of the shells to form top and bottom seals between the strips thereby to form a series of interconnected packages. After the packages are formed by heat sealing, the mating shells are moved in opposite directions away from each other and heated air is subsequently applied to each package so as to shrink the film somewhat thereby to preserve the integrity of the package. Preferably the film is of the nonoriented type and is preheated before being drawn into the half shells.

4 Claims, 10 Drawing Figures
MECHANISM FOR LINING A SERIES OF SHELLS

After a plurality of packages are formed in interconnected following relationship according to U.S. application Ser. No. 31,688 filed Apr. 24, 1970 the packages are severed one from another by any suitable means. One arrangement for severing interconnected packages is disclosed and claimed in U.S. Pat. application Ser. No. 17,459 filed Mar. 9, 1970. While the package itself may take several specific forms, a typical package is disclosed and claimed in U.S. application Ser. No. 49,273 filed Nov. 3, 1970.

According to this invention, the shells of a series of pivotally interconnected shells are lined by a mechanism comprising means for moving the shells along a predetermined path, track means for engaging the shells and for limiting movement in a transverse direction relative to the path of movement, means for moving a sheet of material alongside said shells and in synchronism therewith, and articulated force applying structure disposed alongside said sheet of material and movable in synchronism therewith for applying a uniform force to urge said sheet into engagement with said shells.

For a better understanding of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings in which

FIG. 1 is a plan view of a machine constructed according to the invention and with certain parts broken away for clarity;

FIG. 2A is a sectional view of a half-shell taken along the line designated 2B--2B in FIG. 2A;

FIG. 3 is a plan view of a pair of open shells taken generally along the line 3--3 of FIG. 1 and showing the shells pivotally interconnected at their ends;

FIG. 4 is a perspective view of a completed package formed by this invention;

FIG. 5 is a side view of the mechanism shown in FIG. 1;

FIG. 6 is a cross-sectional view taken along the line designated 6--6 in FIG. 1;

FIG. 7 is a cross-sectional view of the preheating assembly taken along the line designated 7--7 in FIG. 1;

FIG. 8 is a plan view of the return reach of one endless chain of half-shells including the preheat structure, and in which FIG. 9 is a front view of the structure of FIG. 8.

The frame of the mechanism is pivotally shown in the drawings and comprises a pair of horizontal supporting elements designated by the numerals 1 and 2 as well as horizontal support beam 3. These elements are supported by vertical posts and are interconnected by longitudinally disposed struts 4 and 5 mounted at their ends on a pair of vertical pedestals 6 and 7, the vertical supports for longitudinal beam 5 being omitted from the drawings for clarity and simplicity.

Items to be packaged such as the primary packages or cans "C" are fed into the left-hand end of the machine toward the right as indicated by the arrow 8 on a high-speed conveyor 8a. These cans "C" are metered by a pair of star wheels 9 and 10 which are mounted on vertical shafts and rotatable at a speed which is synchronous with the speed of subsequent packaging operations. These star wheels 9 and 10 together with the wedge-shaped structure 10a cooperate to divide the incoming cans "C" into two rows and the rows are arranged to move at a predetermined speed.

For the purpose of dividing the cans "C" in the two rows into packages cans and also in order to impart a predetermined measure of acceleration to the movement of each assembly of cans, accelerating elements 11 and 12 are rotatably mounted on vertical shafts 13 and 14 driven at predetermined speeds and a pair of fingers 15 and 16 are pivotally mounted on elements 11 and 12 respectively and are arranged to perform the desired separating and accelerating functions. While these elements could be assumed different forms, one arrangement which is particularly well suited for use in conjunction with this invention is disclosed and claimed in U.S. application Ser. No. 762,775 filed Sept. 26, 1968 now U.S. Pat. No. 3,521,737.

After the cans "C" are arranged in assemblies adjacent the accelerating wheels 11 and 12 and apparatus associated therewith, the assemblies are formed into a series of packages by means of a pair of chains each chain comprising a plurality of half-shells 23 and designated generally in the drawings by the numeral 17 and 18.

Both those chains are endless and chain 17 is rotatably mounted on rotatable elements 19 and 20 while endless chain 18 is rotatably mounted on rotatable element 21 and another element not shown in FIG. 1 for the sake of clarity but located in the region of the numeral 22. Since both of the endless chains 17 and 18 are identical in construction, only one such chain, i.e., 18 is here described in detail.

As is apparent in the drawings, chain 18 comprises a series of open half-shells designated by the numeral 23. These half-shells ride on rollers 24C and 25C and are pivotally interconnected at their ends and each comprises a pair of outer sidewalls 24 and 25, a pair of inner sidewalls 24A and 25A, and a pair of end walls 26 and 27, as is best shown in FIGS. 2A and 2B. End walls 26 and 27 are recessed inwardly as indicated at 28 and 29. Bottom wall 30 is provided with a series of apertures 31--34 which are interconnected to a manifold best shown at 35 in FIG. 1. Vacuum pressure is supplied to each of the half-shells 23 through its associated manifold 35 and via a series of pneumatic flexible tubes 36 interconnected with a rotatable vacuum header element 37 which in turn is interconnected by means not shown with a source of vacuum pressure also not shown.

The half-shells 23 are provided at their ends with projecting lugs 38 and 39 at one end and with inwardly spaced lugs 40 and 41 at the other end. Suitable pins such as are indicated at 42 and 43 serve to interconnect the lugs at adjacent ends of the adjacent half-shells 23 as best shown in FIG. 3. Thus a pair of continuous chains such as 17 and 18 are provided according to the invention. As is apparent in FIG. 1, an assembly of items such as cans "C" is disposed adjacent the end of each of the working reaches 44 and 45 of the endless chains 17 and 18 as designated generally by the arrow 46.

An endless film feed tract 47 including upper lug chain 47A and lower lug chain 47B and backup plates 48A and 48B is rotatable about double sprockets 48 and 49 and is supported by a series of bolts 50 and holds the filmstrip F1 adjacent the open faces and in contact with the edges 24B and 25B of sidewalls 24A and 25A of shells 23 forming endless chain 18. Since the ends 27 and 28 of the shells 23 are recessed as indicated at 28 and 29, a series of lugs 51 mounted on endless belt 52 are disposed to engage film F1 and to push it into snug engagement with the recesses 28 and 29 thereby to facilitate the vacuum formation of film lining for the shells. Belt or chain 52 is mounted on sprockets 53 and 54 and backup plate 53A supports the working reach of chain 52 against lateral movement toward the left as viewed in FIG. 7.

As is obvious in FIG. 1, clockwise rotation of endless chain 18 and counterclockwise rotation of endless chain 17 causes the half-shells 23 at the location 46 to form a cavity. Since the filmstrip F1 has been drawn into lining relationship within the half-shells 23 comprising the endless chain 18 and since the filmstrip F2 has been drawn into the half-shells 23 comprising the endless chain 17, it is apparent that each assembly of cans is enveloped by two side-by-side mating half-sections of film. Furthermore, it is apparent that these half-sections are interconnected with each other in end to end relationship.

As is apparent particularly in FIG. 6, a jet of superheated air or other gaseous fluid is directed by nozzles 55 and 56 from tanks 55A and 56A respectively along the contacting edge portions of each of the films F1 and F2 both above and below each assembly of cans "C," pressure being applied by the opposed edges 24B and 25B of walls 24A and 25A. This superheated air and the pressure of the edges 24B and 25B of walls 24A and 25A causes the edges of the films F1 and F2 to become securely bonded together.

As shown in FIGS. 1 and 6, the working reaches of chains 17 and 18 engage tracks or rails 23A. For the purpose of bias-
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3

ing the shells 23 of one chain toward the corresponding shells of the other chain, transversely movable tracks or rails 23A are biased inwardly by compressing springs 23C which are provided at the outer ends on fixed supports 23B. The rails 23A engage the rollers 42A and 43A on the half-shells 23B. By this means a firm even pressure is applied to insure a secure bond between films F1 and F2.

After the bonding operation, each package is carried forward from left to right through the machine until it enters the region of the shrink ovens such as 57 and 58 disposed immediately above and below the endless chain 22. The ovens 57 and 58 are disposed transversely movable toward the corresponding shells of the other chain, and in the direction indicated by the arrow 59 onto a suitable timed conveyor which in turn cooperates with suitable mechanism for severing adjacent packages from each other, such as, for example, as the arrangement disclosed and claimed in the aforementioned application Ser. No. 17,459 filed Mar. 9, 1970.

As explained above, the heating operation represented by ovens 57 and 58 may be deflected by the package operating at which an application of heat may be applied to the package in the direction toward the desired shrinking operation. If the shrinking operation is utilized prior to severing, it may be desirable to provide certain cam structure for driving the half-shells somewhat apart so as to allow an application of heat to be made inside the shells and around the girth of the packages so as to be effected within or adjacent to the ovens 57 and 58. In other applications, ovens 57 and 58 may be used for localized or preshrinking only while the final shrinking may be performed subsequently.

As explained above, the film sheets such as F1 and F2 are drawn down into the half-shells associated therewith. This operation, as explained, is a vacuum process and in order to be effective, the film must engage the edges of the half-shell such as edges 24B and 25B of the walls of the half-shells 23. By this means a vertically disposed upwardly extending projecting strip 70 and plate 66 is provided with a vertically disposed downwardly extending projecting strip 71. Interposed between strip 70 and supporting member 60 is a flexible hollow fluid conduit designated by the numeral 72. A similar conduit 73 is interposed between strips 63 and member 71. An application of pressure fluid to the interior of conduits 72 and 73 tends to cause those conduits to expand and thereby to impart sidewise lateral movement toward the right to the structure 47. Spacers 101 and 102 serve to interleave the parts for proper operation of 17 and 18 and their associated interconnected packages "P." In order to shrink the film sufficiently to preserve the integrity of the individual packages and also to provide a structure which is sufficiently sturdy to withstand the subsequent severing operation, an application of heat may be applied to the packages "P" by the ovens 57 and 58 as is best shown in FIG. 5. After the shrink operation is completed the packages are discharged to the right in the direction indicated by the arrow 59 onto a suitable timed conveyor which in turn cooperates with suitable mechanism for severing adjacent packages from each other, such as, for example, as the arrangement disclosed and claimed in the aforementioned application Ser. No. 17,459 filed Mar. 9, 1970.

In order to condition the film F1 and F2 for the application of heat by the ovens 57 and 58 are lined with the film, a preheating stage preferably is incorporated into the machine and method of this invention. Preferably this preheating of the film occurs in the downstream end of the force applying structure 47 adjacent sprocket 48. For the purpose of applying heat to the film, a source of heat is ordinarily employed and by means of conduits disposed along the course of structure 47, hot air may be directed onto the film through suitable ports such as are designated by the numerals 96-100 as best shown in FIG. 9.

The embodiments of the invention in which an exclusive property or privilege is claimed are described as follows:

1. Mechanism for lining the shells of a series of vertically interconnected shells forming a chain of shells comprising means for imparting movement thereto in a predetermined path in end-to-end relation, track means for engaging said shells and for limiting movement thereof in a direction transverse to said path, means for moving a sheet of material in work-forming engagement and alongside said series of shells and in synchronism therewith, force-applying structure disposed alongside edges of said sheet of material and movable in synchronism therewith for applying a controllable uniform force to urge said sheet into secure and firm engagement with the side edges of said shells, said force-applying structure including a movable endless element having its working reach disposed alongside edges of said sheet, an articulated support structure on which said endless element is movably mounted, pressure-applying means for urging said articulated structure into engagement with said shells, and means for applying vacuum pressure to the interior of said shells.

2. Mechanism according to claim 1 wherein said pressure-applying means comprises an elongated hollow device of flexible material disposed along the length of said support structure.

3. Mechanism according to claim 2 wherein said pressure-applying means comprises an elongated hollow device of flexible material disposed along the length of said support structure.

4. Mechanism according to claim 1 wherein for heating said sheet is disposed to perform at least a part of a heating operation prior to the application of vacuum pressure to said
shells and includes a source of heated gas and a system of conduits for diverting heated gas through said force-applying means to said sheet during movement thereof.