Nov. 16, 1971 K. S. CARMICHAEL 3,619,910

PACKAGING APPARATUS

Original Filed July 15, 1968 8 Sheets-Sheet 1

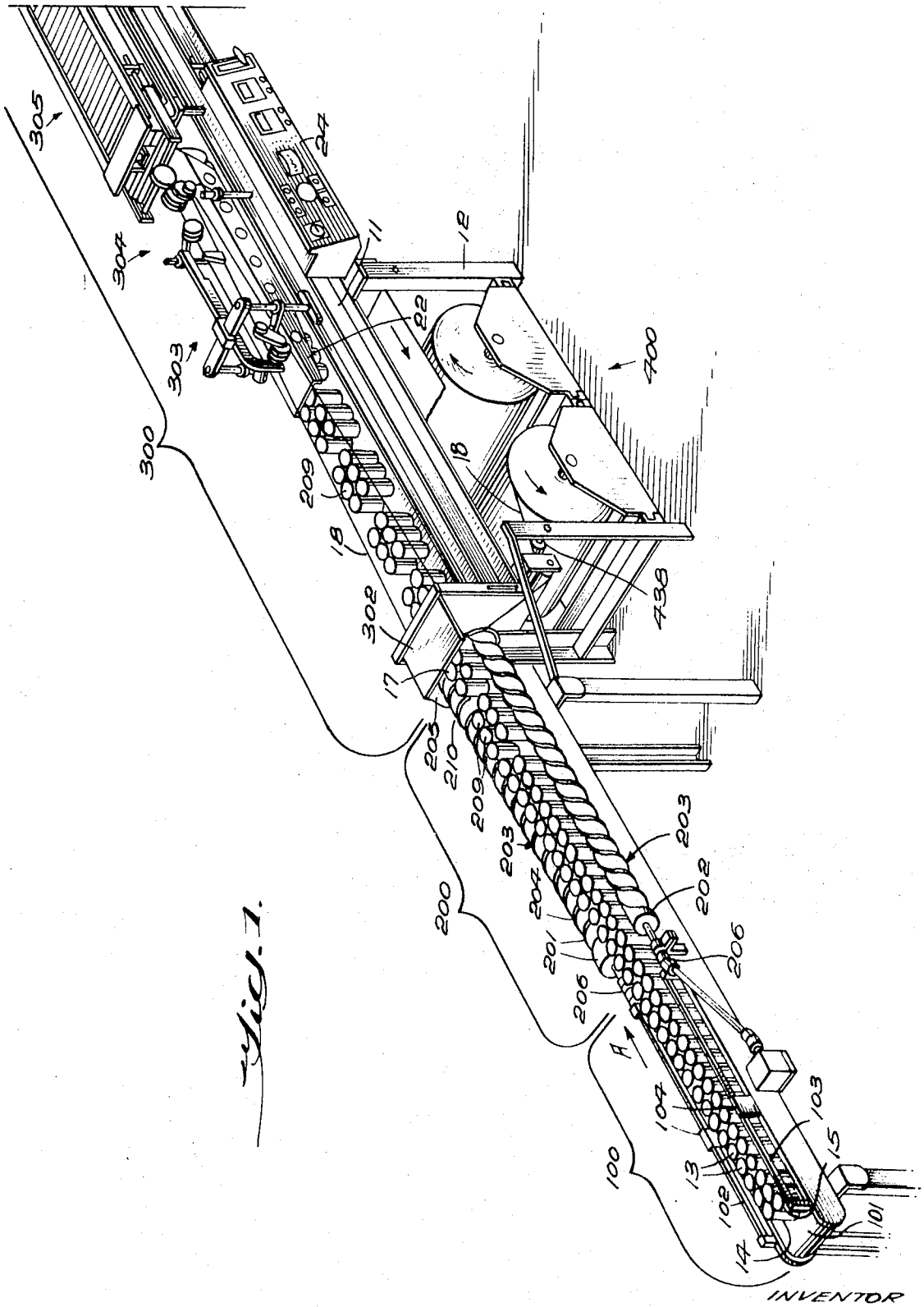


Fig. 1.

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PACKAGING APPARATUS

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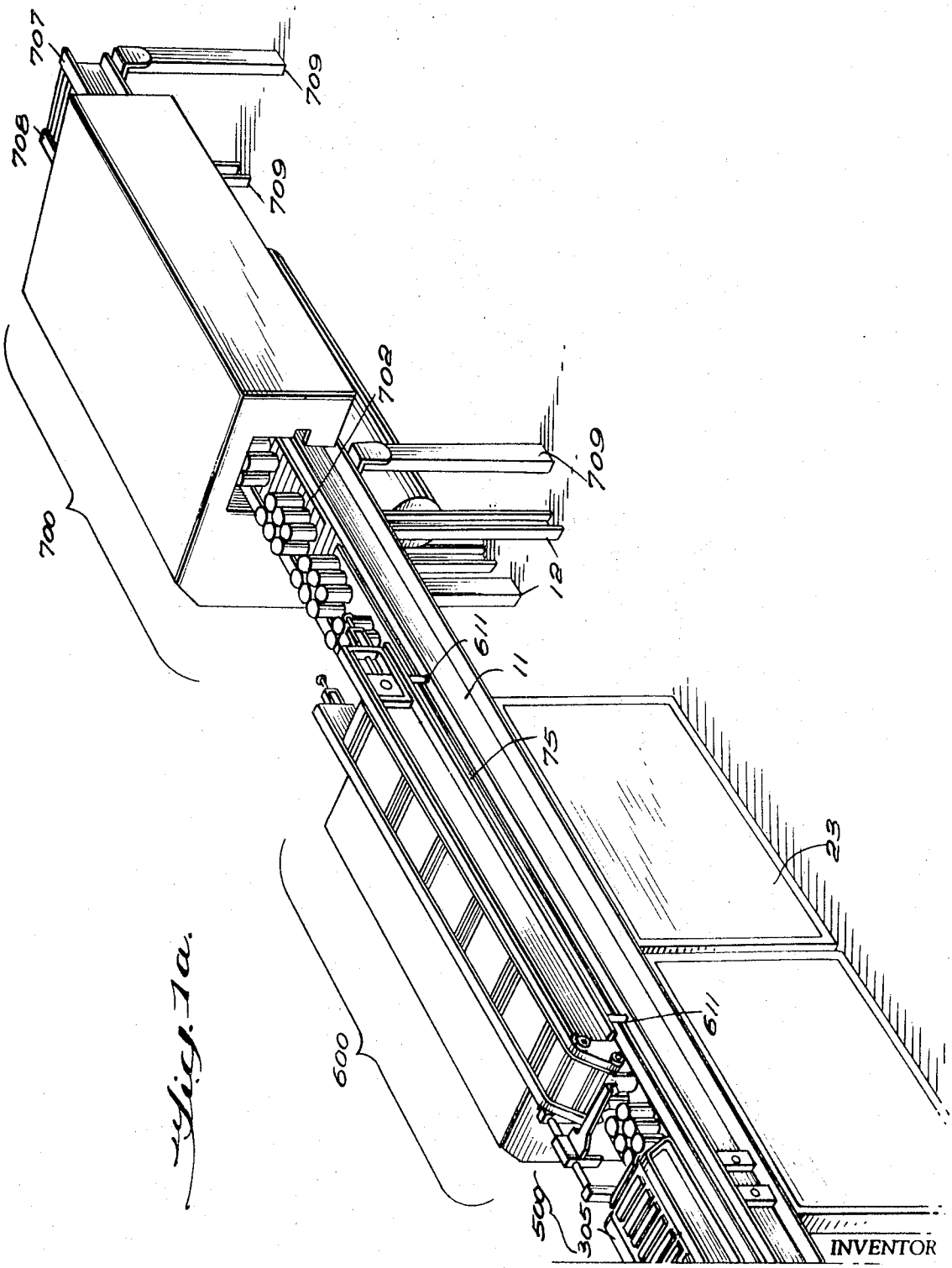


Fig. 7a.

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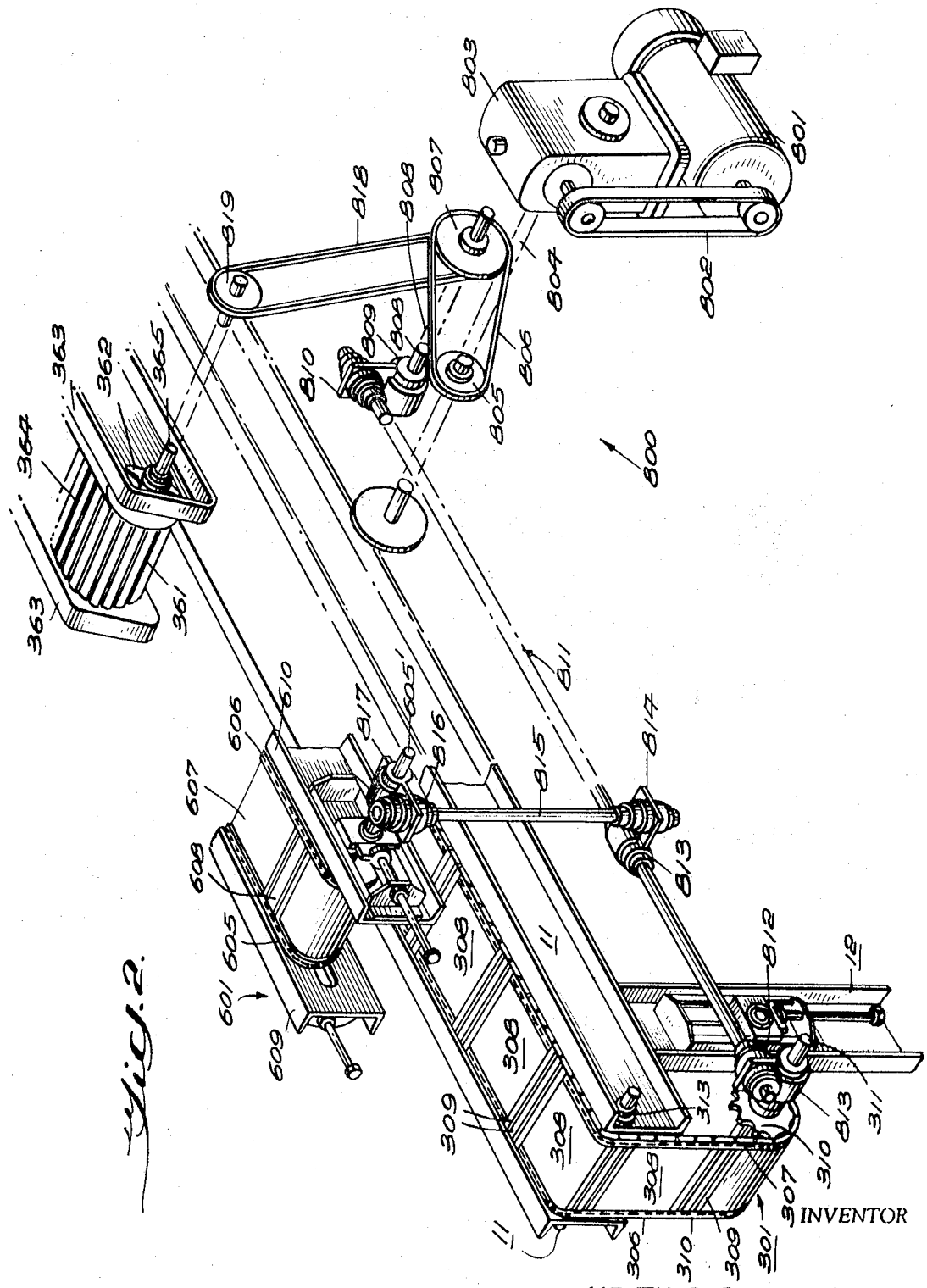


Fig. 2.

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PACKAGING APPARATUS

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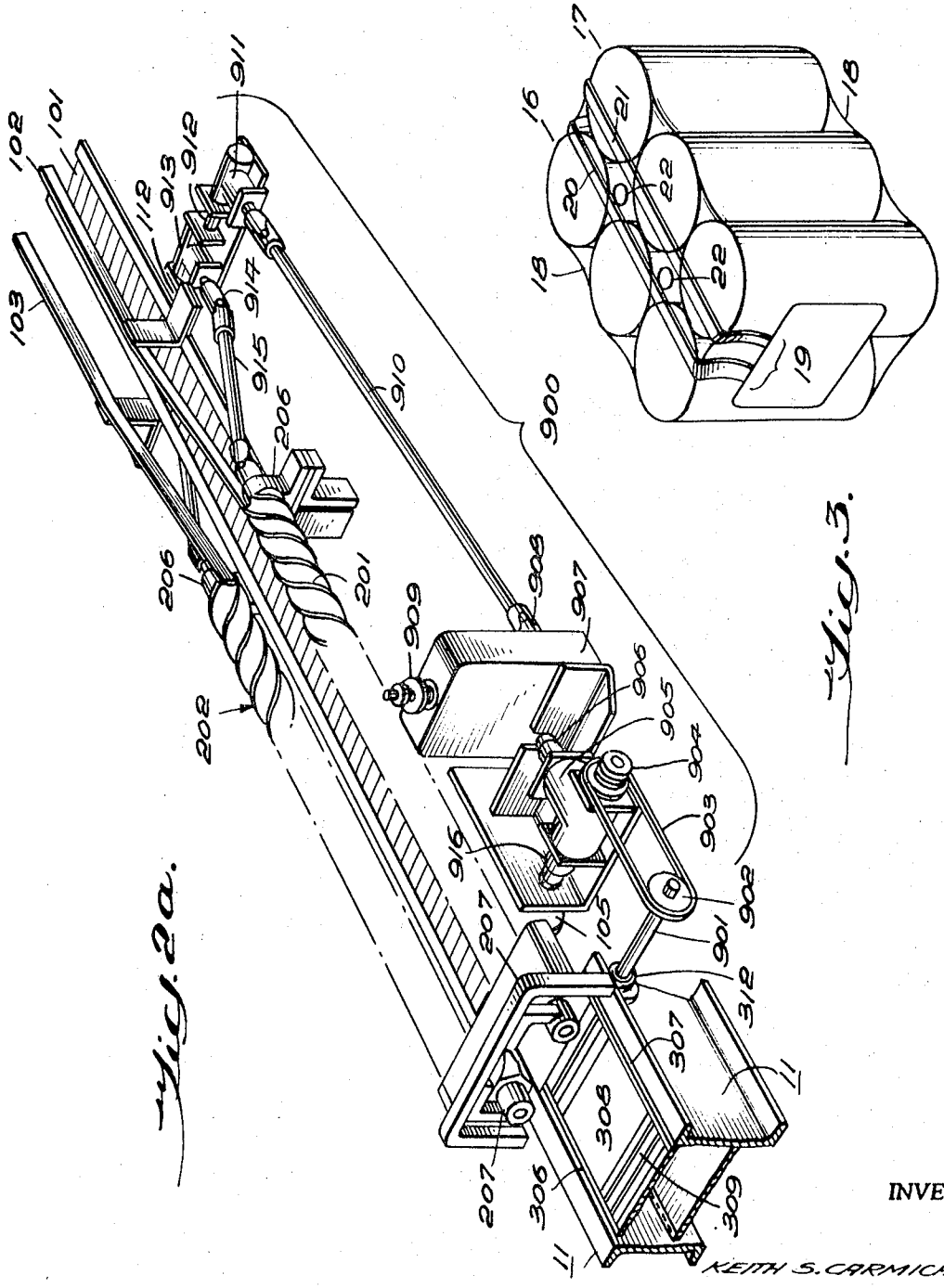


Fig. 2a.

Fig. 3.

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PACKAGING APPARATUS

Original Filed July 15, 1968 8 Sheets-Sheet 5

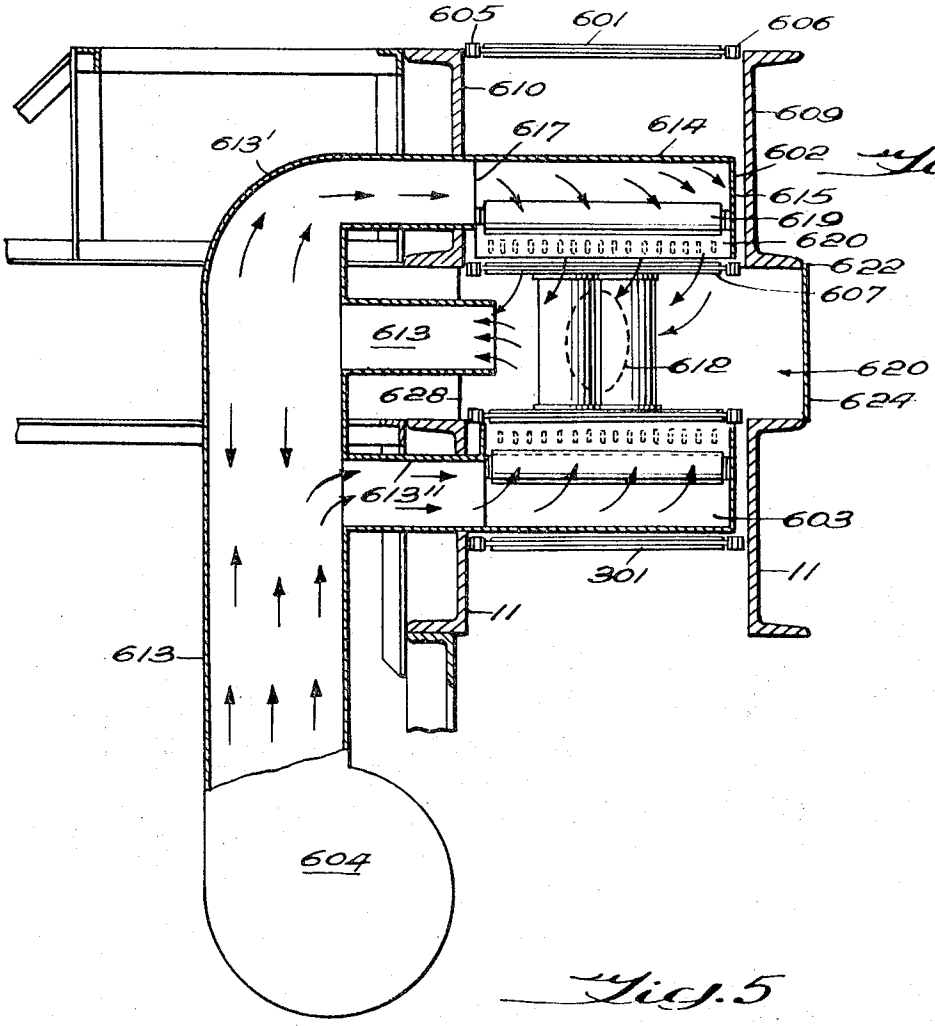
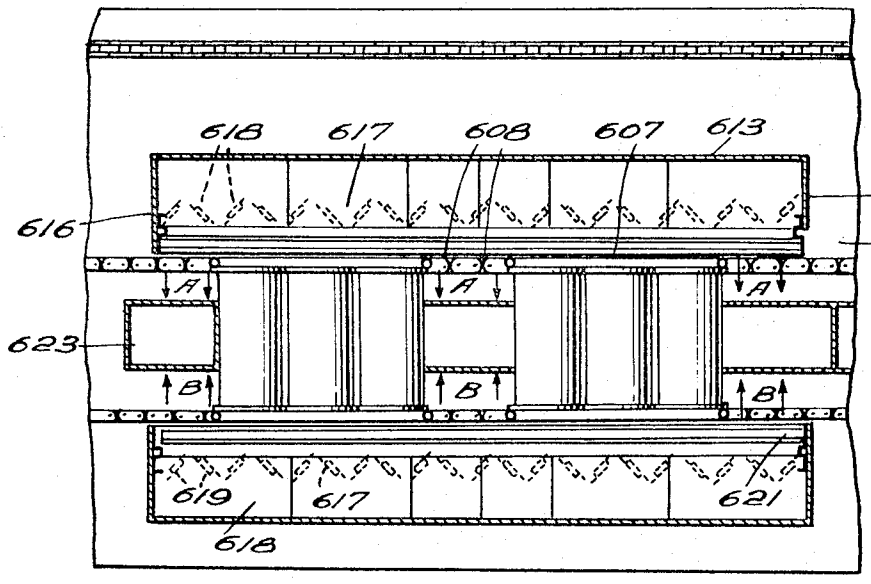


Fig. 4.

Fig. 5



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Fig. 6

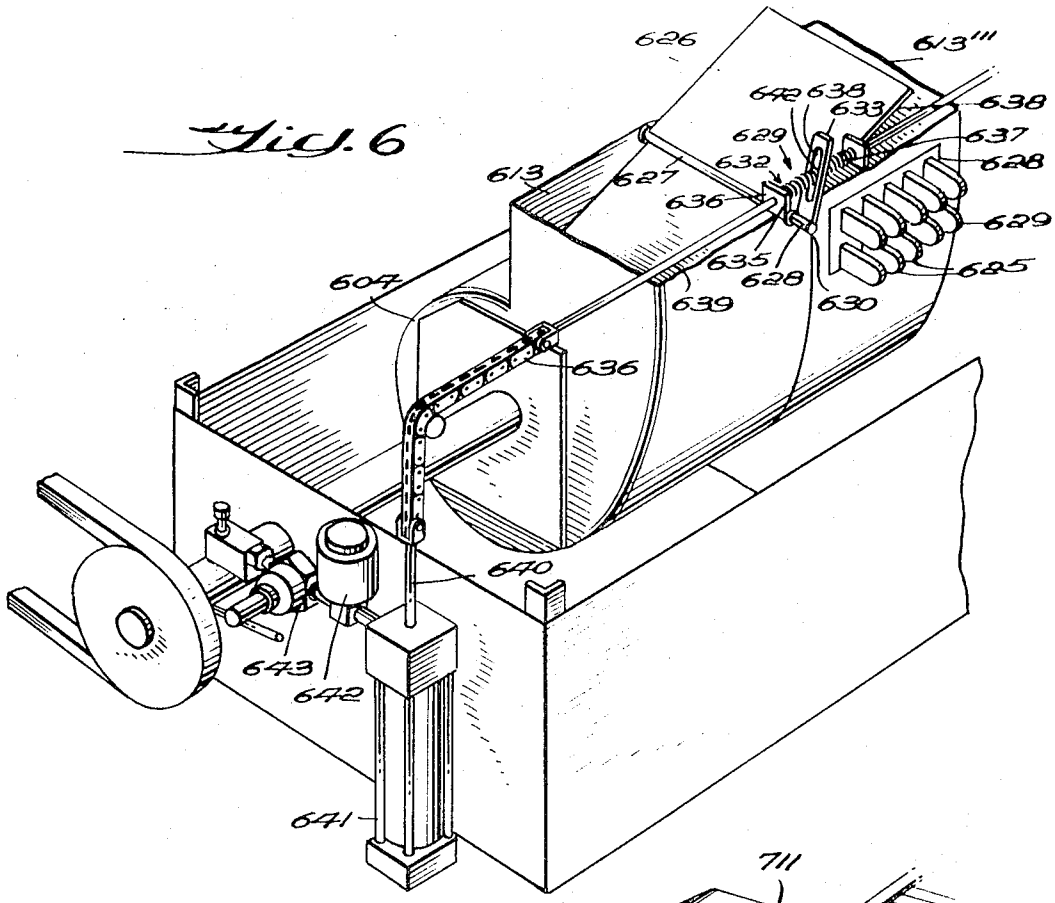
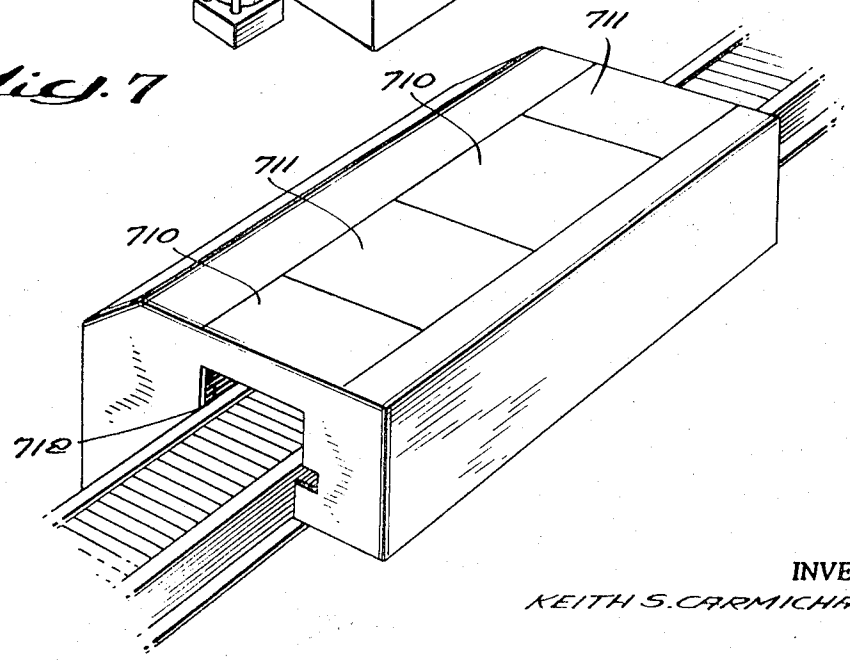


Fig. 7



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Fig. 8

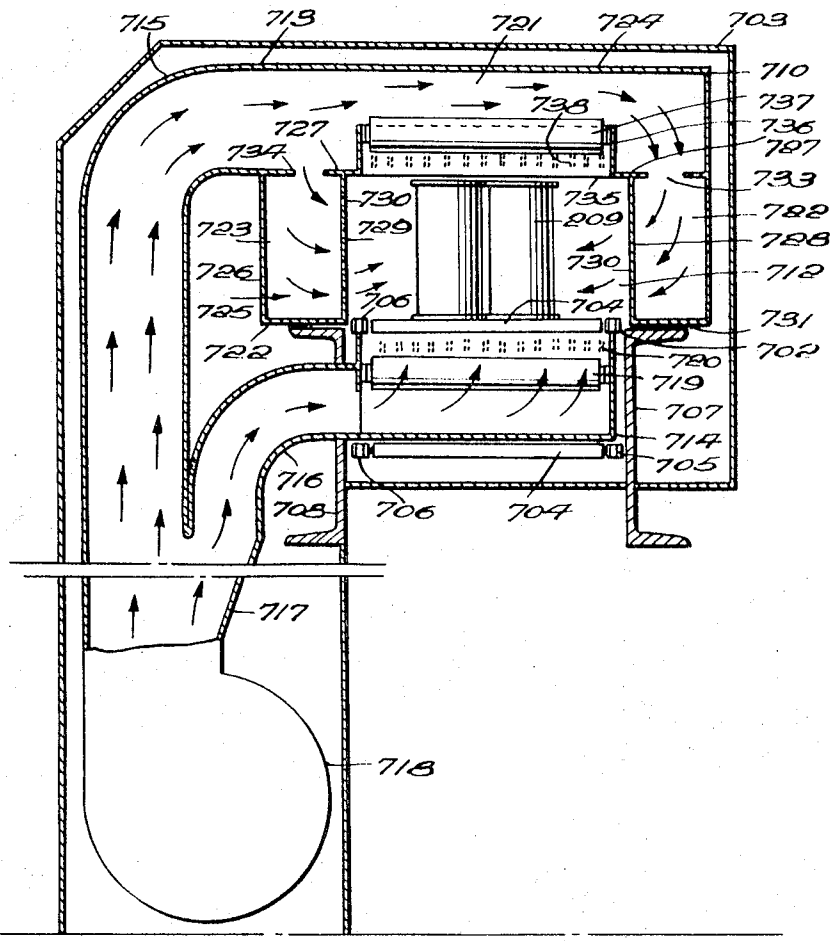
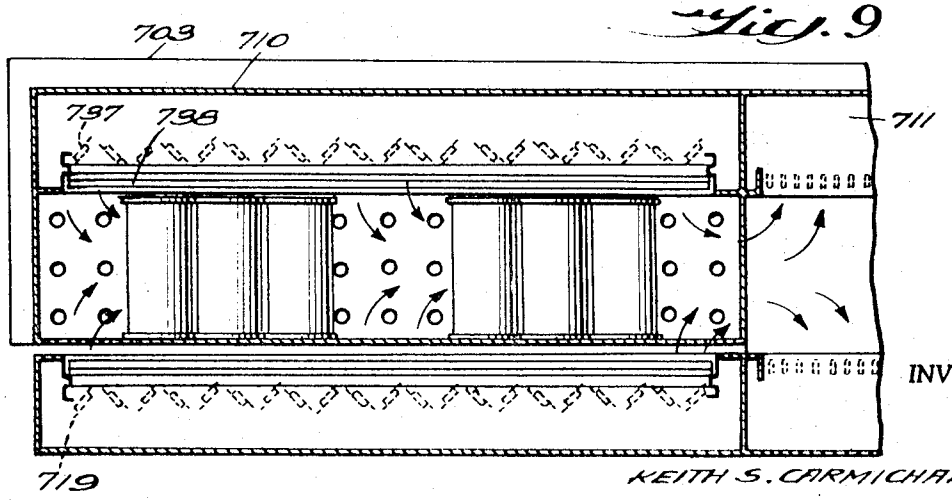


Fig. 9



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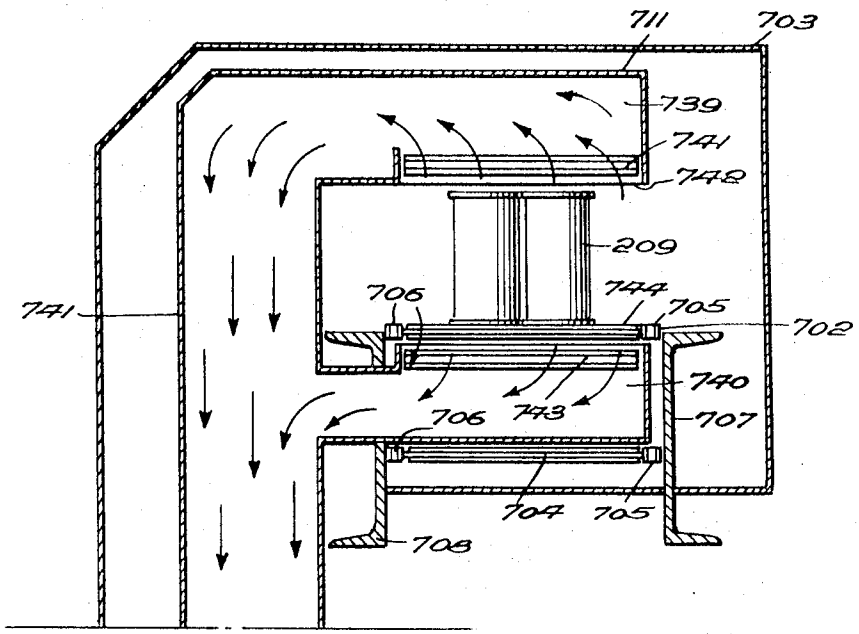
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PACKAGING APPARATUS

Original Filed July 15, 1968 8 Sheets-Sheet 8

Fig. 10



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United States Patent Office 3,619,910 Patented Nov. 16, 1971

3,619,910

PACKAGING APPARATUS

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Original application July 15, 1968, Ser. No. 744,848. Divided and this application Apr. 9, 1970, Ser. No. 26,927

Int. Cl. B65b 1/02

U.S. Cl. 34—216 2 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for packaging articles such as cans in an overwrap of thermoplastic polymeric material is provided wherein said apparatus comprises means for grouping a pluralty of articles to be packaged, means for enwrapping said articles with said film, means for heat-sealing overlapped edge portions of said film and enclosing said articles therewithin, means for separating said film-enwrapped grouped articles, and means for shrinking said heat-sealed film to provide a package of grouped articles characterized by a substantially wrinkle-free film extending over the top, bottom, sides and portions of the ends of said grouped articles.

CROSS REFERENCE TO RELATED APPLICATION

This application is a division of my copending application Ser. No. 744,848, filed July 15, 1968, now U.S. Pat. 3,572,004, issued Mar. 23, 1971.

THE INVENTION

The present invention relates to a packaging apparatus and, more particularly, is directed to a novel high speed apparatus for continuously and automatically packaging groups of articles to form packaged units of increased suitability for efficient handlng, transport, and storage. More specifically, the invention relates to a new high speed apparatus for packaging cylindrical articles such as cans to form a package consisting of six cans which is commonly referred to as a "six-pack" using continuously-supplied flexible heat-sealable and heat-shrinkable film or sheet of preferably transparent material.

Packaging arrangements and apparatus heretofore employed have involved bringing groups of articles and individual pre-formed package units into operative association in a noncontinuous manner, but rather intermittent in the operation of at least a number of the significant packaging steps and apparatus components. This has prevented the attainment of high packaging speeds and has resulted in fairly complex indexing mechanisms or drives. In the package resulting from the arrangement of this invention, the articles, or cans, themselves are not only supported and contained thereby, but actually form an integral and necessary part of the package providing structural unity and stability to the otherwise unrelated sleeve member. The packed articles are a necessary component of the package so that the placing and securing of the articles into proper position with respect to each other and the package components must be carried out substantially concurrently to effect formation of the package. Accordingly, it is the principal object of the present invention to provide a packaging apparatus especially adapted for continuous and high speed packaging operation.

According to the present invention there is provided an apparatus for packaging articles such as, for example, cylindrical cans in an overwrap of thermoplastic polymeric material in film form; said apparatus comprising means for providing a plurality of grouped articles to be packaged, means for providing said film, means for enwrapping said articles with said film, means for heat-sealing the overlapped edges of said film and enclosing said articles to be packaged therewithin, means for separating said film-enwrapped grouped articles, and means for shrinking said heat-sealed film to provide a package of grouped articles characterized by a substantially wrinkle-free film extending over said grouped articles.

The apparatus of the present invention is automatic and of continuous operation, receives a continuous stream of regular articles of substantially uniform size, separates the articles into spaced groups, moves said groups of articles continuously along a given line of movement, forms continuously supplied flexible film around said groups as the groups move along said line of movement, continuously seals the overlapped edges of said flexible film to form a unitary sleeve assembly surrounding said groups as they move along said line of movement, continuously severs the sleeve assembly between said groups to form individual groups of articles each enclosed by a tubular sleeve member having open end portions, shrinks the open end portions of each sleeve member into engagement with the articles at the ends of the contained group of articles, and then further shinks each entire sleeve member into close engagement with all of the articles in its contained group.

The nature and advantages of the invention will be more clearly understood by the following description and the several views illustrated in the accompanying drawings wherein like reference characters refer to the same parts throughout the several views and in which:

FIGS. 1 and 1*a* are perspective views illustrating the general features of the apparatus of the nvention;

FIGS. 2 and 2*a* are diagrammatic perspective views of the drive mechanism for the apparatus of FIG. 1;

FIG. 3 is a perspective view of a preferred package produced by the apparatus of the invention;

FIG. 4 is a transverse cross-sectional view of the pre-shrink means of the apparatus of FIG. 1;

FIG. 5 is a side elevation view of the pre-shrink means of FIG. 4;

FIG. 6 is a perspective view showing the control features of the pre-shrink means depicted in FIG. 5;

FIG. 7 is a perspective view of the final heat-shrink means of the apparatus shown in FIG. 1;

FIG. 8 is a transverse cross-sectional view of the air supply module of the final shrink means of FIG. 1;

FIG. 9 is a longitudinal cross-sectional view along lines **26—26** in FIG. 8;

FIG. 10 is a transverse cross-sectional view of the exhaust module of the final heat-shrink means of the apparatus shown in FIG. 1.

GENERAL DESCRIPTION

The packaging apparatus herein disclosed in illustration of the invention is shown in FIGS. 1 and 1*a* and comprises in cooperative association and assembly an article feed section **100**, an article grouping section **200**, a film-tube forming section **300**, a film supply section **400**, a film-tube separating and package forming section **500**, a film pre-shrink section **600** and a film final shrink section **700**. The motive power for driving the apparatus of the invention is shown in FIGS. 2 and 2*a* and comprises drive power section **800** and drive power section **900**.

The mechanical members constituting the apparatus of the present invention as shown in FIGS. 1 and 1*a* are supported in cooperative association by a base frame support assembly **10** composed of suitable main frame members **11** so constructed and arranged as to present a support frame resting upon a plurality of suitably disposed leg members such as **12** that are secured to said frame.

The general operation of the apparatus of the present invention is that articles **13** to be packaged such as cans, bottles, etc., are aligned in adjacent rows **14** and **15** in article feed section **100** which advances the aligned articles in the direction of arrow A. The advancing articles next enter into article grouping section **200** wherein the aligned articles are accumulated and formed into groups of any number of articles, preferably six in number. The article groups are automatically spaced from each other and advanced into the film-tube forming section **300**. The travelling spaced article groups are enwrapped with a preferably transparent flexible wrapping film **18** which is fed continuously from a source or supply thereof in roll form from film supply section **400**. The wrapping film is transformed in section **300** from a flat sheet into a tubular structure that enwraps the continuously travelling line of spaced article groups, and the opposed longitudinally extending edges of the wrapping film are overlapped a suitable amount and heat-sealed together in the region of the overlap to provide a continuous tubular film that surrounds the travelling line of spaced article groups. The enwrapped or encased travelling line of spaced article groups are preferably next separated into separate article groups by advancing through film-tube separating and package forming section **500** wherein the tubular film is severed automatically at a point intermediate each adjacent spaced article group in the line thereof. The separate overwrapped article groups are next each advanced through a pre-shrink section **600** wherein a heated medium, preferably air, is directed against substantially only the end portions thereof whereby to selectively pre-shrink each end of the tubular wrapping film against the end articles of the article groups. The article groups are next advanced through a final shrink section **700** wherein each package is subjected to a heated medium over substantially its entire surface thereby to shrink the entire tubular wrapping film to provide a unitary package of wrapped articles characterized by a wrapping film tightly drawn over the sides, top, bottom and portions of the ends of each article group. The preferred package of six articles is shown in FIG. 3 which depicts two contiguous rows **16** and **17** each containing three containers enwrapped with a tightly-fitting heat-shrunk film **18** of flexible, transplant thermoplastic material such as, for example, polyethylene. As shown in FIG. 3, the overlapped edge portions of the film wrap is at **19** and the heat-seal in the region of the overlap is along heat seal lines **20** and **21** that are disposed in a parallel manner with respect to each other. Suitable holes **22** may be provided in the region of the film overlap between four contiguous cans to provide carrying aids adapted to accommodate fingers for lifting and carrying the package.

A more detailed description of the apparatus of the present invention is set out herebelow.

FILM PRE-SHRINK

The film pre-shrink means is depicted at **600** in FIG. 1*a*. The specific features and construction of the pre-shrink means is shown in greater detail in FIGS. 4, 5 and 6. The film pre-shrink means comprises endless belt conveyor **301**, endless travelling belt **601**, top plenum chamber **602**, bottom plenum chamber **603**, blower or air circulator **604** and suitable ductwork interconnecting the plenum chambers with air circulator **604** so constructed and arranged as to provide an enclosure or tunnel **620** through which article groups **209** travel. As shown in FIGS. 1, 4 and 5, separated article groups **209** are advanced through pre-shrink means **600** on endless belt conveyor means **301** described hereinabove. Upon entering pre-shrink means **600**, the top portion of each article group **209** contacts endless traveling belt **601** consisting of endless chains **605** and **606** having pad elements **607** and rods **608** spaced therealong and connected therebetween. Endless travelling belt **601** is supported for vertical adjustment between spaced support members **609** and **610** which are in turn

connected to main frame members **11** by suitable means such as posts **611** (FIG. 1) and supported thereby. Endless travelling belt **601** is adapted to be driven in timed relation to endless belt conveyor **301** by sprocket assemblies secured between support members **609** and **610** adjacent each end thereof. Pads **607** and rods **608** of endless travelling belt **601** are identical in construction and design to pads **308** and rods **309** of endless belt conveyor **301**. The top portion of article groups **209** contact pad elements **607** of endless travelling belt **601** upon entering pre-shrink means **600** so that the entire top and bottom portions of article groups **209** are covered respectively by pads **607** and pads **308** as the article groups advance through the pre-shrink. The pre-shrink means **600** is adapted to direct a heated gaseous medium such as air at the end portions of wrapping film **18** which extends past the ends of separated article groups **209** thereby to shrink the wrapping film thereat for engaging the ends of each article group **209**. Preferentially shrinking the end portions of wrapping film **18** before shrinking the entire wrapping film over the article groups is preferred because the pre-shrink secures or locks the end film portions in place as shown at **612** (FIG. 4) preventing the film from sliding over either the top or bottom portions of the end articles of article groups **209** when the latter are subjected in their entirety to the final heat shrinking operation.

The heated air is directed against the wrapping film by means of blower **604** which moves heated air into and through ductwork **613** so constructed and arranged to deliver the heated air into top plenum chamber **602** and bottom plenum chamber **603**. Top plenum chamber **602** is characterized by a flat top wall **614** connected to depending side walls **615** and end walls **616**; one of side walls **615** is provided with an opening **617** for engaging a branch **613'** of ductwork **613** for admitting heated air thereinto. The bottom portion of plenum chamber **602** is open and provided with volume flow control means **618** consisting of a plurality of adjustable vanes **619** rotatably secured between sidewalls **615** adapted to be either closed or opened any desirable amount for controlling the amount of heated air circulated therethrough. The bottom portion of plenum chamber **602** also is provided with flow direction control means consisting of a plurality of adjustable vanes **621** rotatably secured between end walls **616**. As shown in FIGS. 4 and 5, the entire plenum chamber **602** assembly is supported between support members **609** and **610** intermediate the upper and lower flights **622** and **623** of endless travelling belt **601**. Heated air passing through volume flow control means **618** and flow direction control vanes **621** is directed through the spaced rods **608** of endless travelling belt **601**, as indicated by arrows A in FIG. 5, onto the end portions of wrapping film **18** extending beyond each end of each article group and into enclosure **620**. As shown in FIG. 4, enclosure **620** is provided by endless belt conveyor **301**, endless travelling belt **601** and sidewalls **624** and **625** between support frame members **11**, **609** and **610**.

The bottom plenum chamber **603** is identical in construction and design to plenum chamber **602** except that it is secured in position between main assembly frame members **11** intermediate the upper and lower flights of endless belt conveyor **301**. Heated air enters bottom plenum chamber **603** from a branch duct **613''** of ductwork **613** and flows upwardly through volume flow control means **618** and flow direction control vanes **621** and through spaced rods **309** of endless belt conveyor **301**, as indicated by arrows B in FIG. 5, onto the exposed end portions of wrapping film **18** that are not covered by pad element **308**.

Heated air in enclosure **620** is recirculated to blower **604** via branch duct **613'''** that penetrates into enclosure **620** through sidewall **625**. The recirculating air is heated to any desired temperature by means of an electrical heater device **628** consisting of a plurality of heaters **629** adapted to be connected to a suitable source of electrical

energy. The heater device **628** is secured in the return duct **613'''** of ductwork **613**, as shown in FIG. 6. A unique control feature embodied in pre-shrink means **600** comprises a damper device having a damper plate **626** secured to a rod **627** rotatably mounted in ductwork **613**. Rod **627** extends through a wall of ductwork **613**, as indicated at **630**, to provide an extension for securing actuating means **632** thereto which consists of a slotted bar **633** having an actuating pin **634** extending through the slot therein. Actuating pin **634** also extends through a spring **635** intermediate slotted bar **633**, and keeper **636** and another spring **637** intermediate slotted bar **633** and keeper **638**, and one end of actuating pin **634** is connected by suitable means such as chain **639** to the piston rod **640** of pneumatically operated cylinder **641**. One end of spring **635** abuts directly against slotted bar **633**, but the end of spring **637** adjacent bar **633** abuts against a keeper **642** secured to pin **634**, and spring **635** exerts a greater force on bar **633** than spring **637** for urging damper plate **626** clockwise (FIG. 13) so that normally damper plate **626** restricts air flow through ductwork **613**. Cylinder **641** is adapted to be energized by introducing a hydraulic fluid medium thereinto through a suitable valve **643** for moving the piston element therein and piston rod **640** connected thereto for exerting a pull through chain **639** on actuating pin **634**, as shown in FIG. 6, thereby to cause damper plate **626** to pivot about rod **627** and rotate counterclockwise thus permitting the flow of air through ductwork **613**. On the other hand, to prevent excessive build-up of heat in enclosure **645** during temporary operational shutdown of the apparatus, an electrical signal energizes normally open solenoid shut-off valve **644** which also vents the pressure in cylinder **641** thereby deenergizing cylinder **641** to release the pull on pin **634**, and thus permit spring **635** to exert its force against slotted bar **633** which acts against keeper **642** to cause rod **630** and damper plate **626** to rotate clockwise, as shown in FIG. 6, for restricting the flow of air through ductwork **613**.

As shown in FIG. 1, article groups **209** exit from film pre-shrink means **600** and advance to film final shrink section **700** as separate packages having the wrapping film at each end thereof heat-shrunken against and about the end articles of each article group.

FILM FINAL SHRINK

Film shrink means **700** comprises support frame **701**, endless conveyor **702** and suitable ductwork so constructed and arranged to provide a heated enclosure or tunel **712** through which article groups **209** are conveyed for heat shrinking wrapping film **18** thereby to provide the package as shown in FIG. 3.

The endless conveyor member **702** of shrink means **700** includes a plurality of spaced roller elements **704** suitably rotatably secured at each end to endless chains **705** and **706**. The endless chains may be driven by an suitable arrangement as by a sprocket assembly operatively secured between support frame members **707** and **708** adjacent each end thereof and coupled to a prime motive source.

Support frame **701** also includes support legs **709** each connected at one end to either of support frame members **707** and **708** whereby to present endless conveyor **701** in alignment with endless conveyor **301** thereby to afford a continuing path or line of travel for article groups **209**.

The ductwork **703** of film shrink means **700** is compartmented to provide in series heated air supply modules **710** and heated air exhaust modules **711**, as indicated in FIG. 7. The air supply module **710** is depicted in greater detail in FIGS. 8 and 9, and air exhaust module **711** is shown in greater detail in FIG. 10.

Referring to FIGS. 7, 8 and 9, heated air supply module **710** comprises a flow duct assembly **713** and a bottom plenum chamber **714** each operatively connected to branch ducts **715** and **716**, respectively, of main duct **717** that is operatively connected to air circulator or blower **718**. Bottom plenum chamber **714** is identical in construction and design to plenum chamber **603** of film pre-shrink means **600** described hereinabove. Bottom plenum chamber **714** is secured in position between support frame members **707** and **708** intermediate the upper and lower flights of endless conveyor **702**. Heated air is adapted to enter plenum chamber **714** from branch duct **716** and flow upwardly through volume flow control means **719** and flow direction control means **720** and through or between spaced roller elements **704** and onto the surface of wrapping film **18** adjacent the bottom portion of article groups **209**.

Flow duct assembly **713** is of inverted U-shaped cross-section having a main flow passage **721** in communication with side flow passages **722** and **723**, and comprises a top wall **724** connected to depending sidewalls **725** and **726** and a bottom wall **727** connected to perforated sidewalls **728** and **729** having a plurality of apertures **730** therein. Preforated sidewalls **728** and **729** are connected to sidewalls **725** and **726** by means of bottom walls **731** and **732**, respectively, thereby to provide side flow passages **722** and **723**. Bottom wall **727** of flow passage **721** is provided with suitable apertures **733** and **734** providing direct communication between flow passages **721** and **722** and between flow passages **721** and **723**. Bottom wall **727** also is provided with a large aperture **735** having an upstanding flange **736** extending therearound for supporting and accommodating volume flow control means **737** and flow direction control means **738**. Volume flow control means **737** and flow direction control means **738** are identical in construction and design to volume flow control means **719** and flow direction control means **720**. Heated air is adapted to enter flow duct assembly **713** from branch duct **715** and be distributed therein through flow passage **721** to side flow passages **722** and **723** and through apertures **730** in the latter into enclosure **712** and against wrapping film **18** adjacent to the sides of article groups **209**. The heated air in flow passage **721** also is adapted to flow through both volume flow control means **737** and flow direction control means **738** and aperture **735** onto the wrapping film **18** adjacent the top portion of article groups **209**.

The heated air entering enclosure **712** from flow assembly **713** and plenum chamber **714** virtually bathes each article group **209** in a sea of hot air which results in shrinking wrapping film **18** into tight engagement with the articles of group **209** to provide the package shown in FIG. 3.

The heated air exhaust module **711** is shown in greater detail in FIG. 10 and comprises upper plenum chamber **739** and bottom plenum chamber **740** each in communication with return duct **741** which is operatively connected to blower **718**. Upper plenum chamber **739** is provided with flow direction control vanes **741** suitably supported in aperture **742** therein, and the entire plenum chamber assembly is disposed immediately above article groups **209**. The lower plenum chamber **740** is secured between frame supports **707** and **708** intermediate the upper and lower flights of endless conveyor **702**. The lower plenum chamber **740** also is provided with flow direction control vanes **743** suitably supported in aperture **744** therein. Blower **718** is adapted to exhaust the hot air adjacent article groups **209** in enclosure **712** by way of plenum chambers **739** and **740** and return duct **741**. Also, the exhaust air travelling in return duct **741** is directed over a bank of electrical heaters (not shown) suitably disposed therein and operatively connected to a source of electrical energy.

The entire final film shrink means **700** is preferably enclosed by an outer cover or shroud **703** of suitable material such as stainless steel to provide a guard especially against the heated components therein. Suitable insulation also is preferably provided on the inside of cover **703**.

I claim:

1. Apparatus for packaging a plurality of articles wherein spaced groups of the articles are each enclosed in a

sleeve of heat shrinkable wrapping film having end portions extending beyond the ends of each article group, the improvement comprising:

film pre-shrink means to first shrink substantially only the open end portions of each sleeve against the ends of each article group, said pre-shrink means including top and bottom plenum chambers, an endless conveyor for continuously moving the spaced groups of articles through the said pre-shrink means, an endless belt positioned above the article groups and adapted to be driven in timed relation to said endless conveyor, means for blowing hot air into said top and bottom plenum chambers and through openings in said belt and said conveyor and substantially only onto the end portions of each of said sleeves, and

final shrink means for shrinking each entire sleeve into engagement with the articles in each group.

2. Apparatus of claim 1 wherein said belt and said conveyor each include a plurality of spaced pads extending therealong with a pad of said conveyor and a pad of said belt being adapted to respectively completely cover the entire top and bottom portions of each article group as it moves through said film pre-shrink means and said spaced pads of said conveyor and said belt each defining said openings therein and therebetween.

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U.S. Cl. X.R.

53—184