Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

PACKAGING MACHINE

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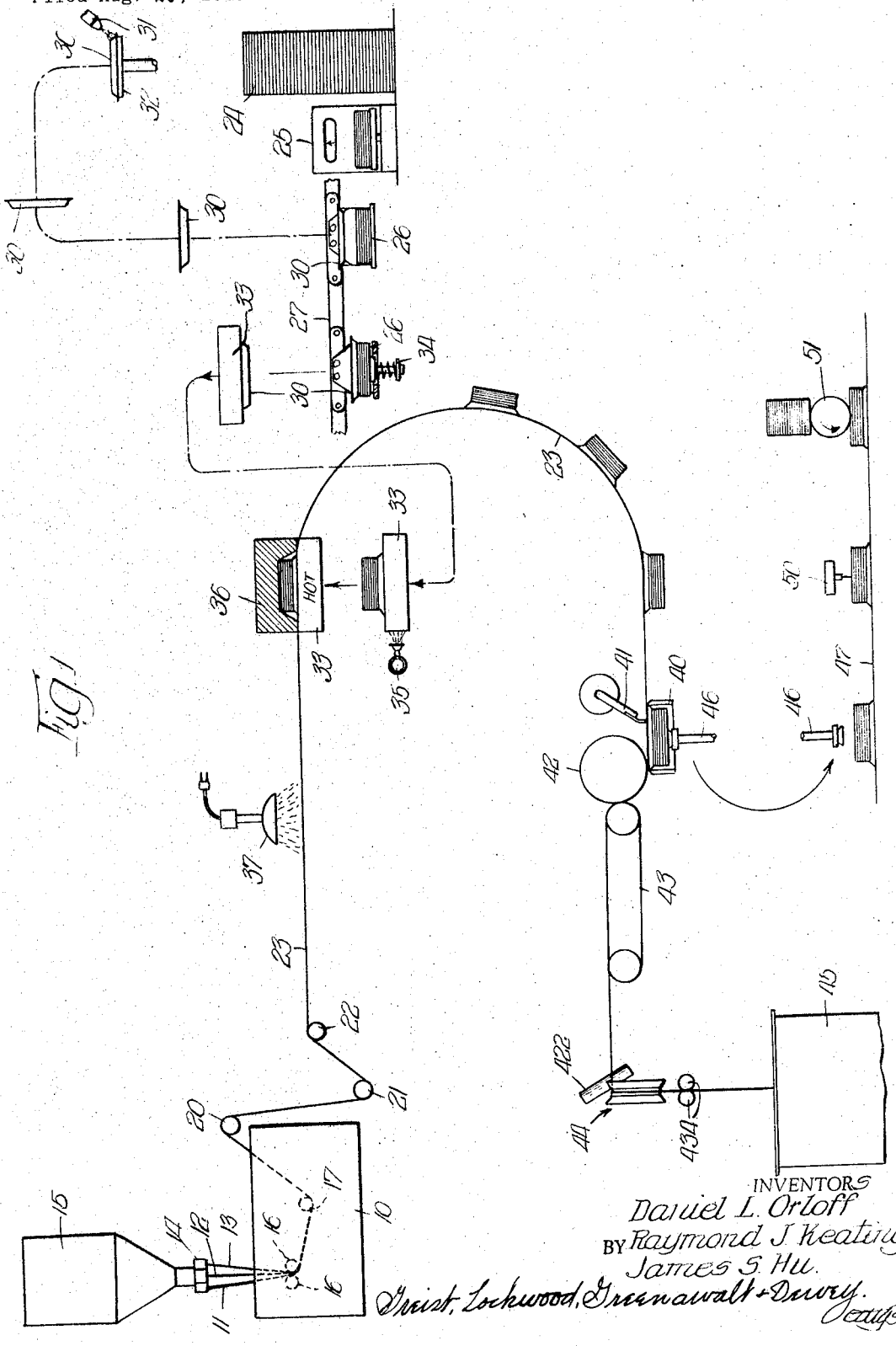

Fig. 1

INVENTORS
Daniel L. Orloff
BY Raymond J. Keating
James S. Hu.
Driscoll, Lockwood, Greenawalt & Dewey.
Attys

Jan. 24, 1967 D. L. ORLOFF ET AL 3,299,608

PACKAGING MACHINE

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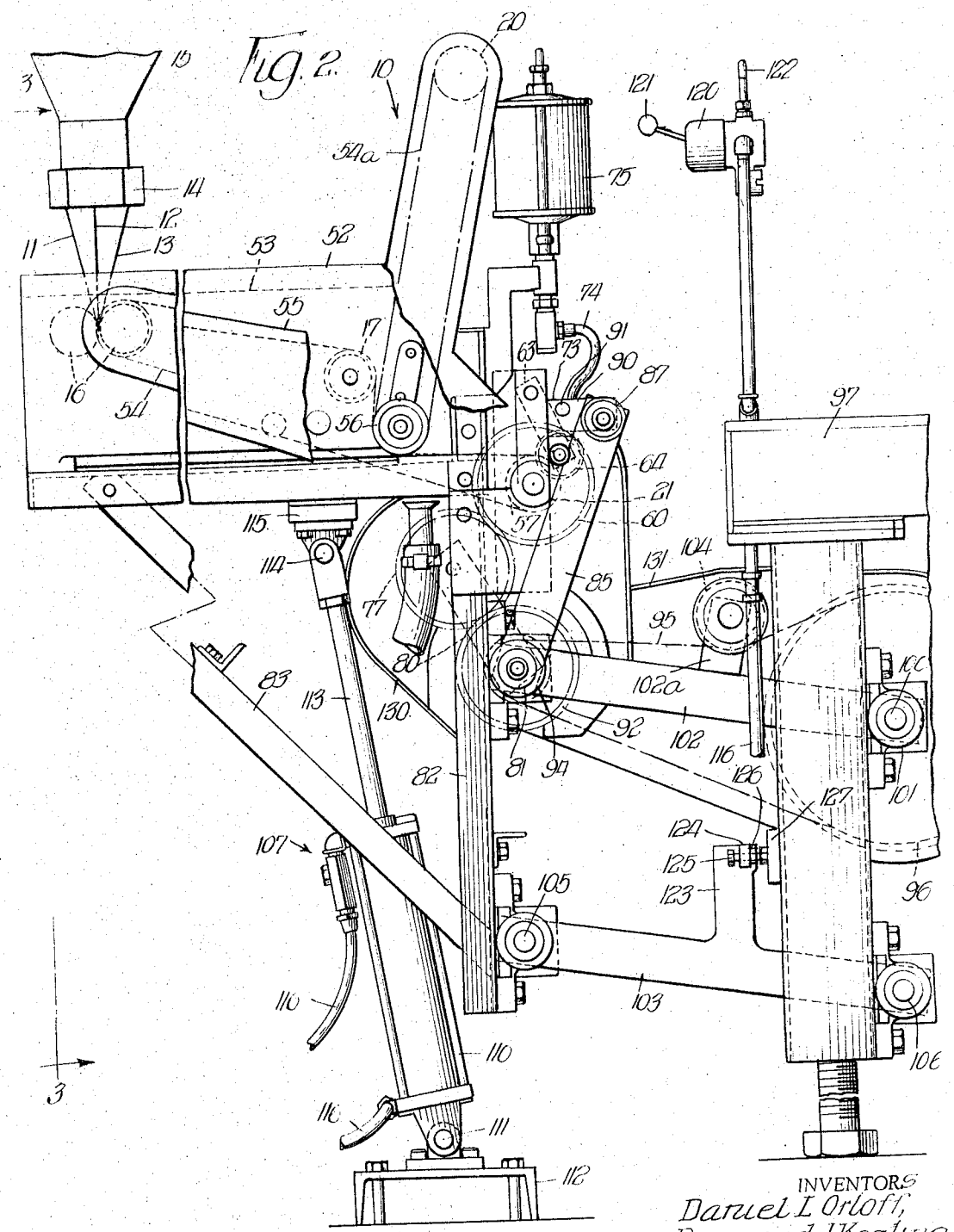
Fig. 2.



INVENTORS
Daniel L Orloff,
BY Raymond J. Keating,
James S. Hu,
Brisk, Lockwood, Greenawalt & Dewey
Attys

PACKAGING MACHINE

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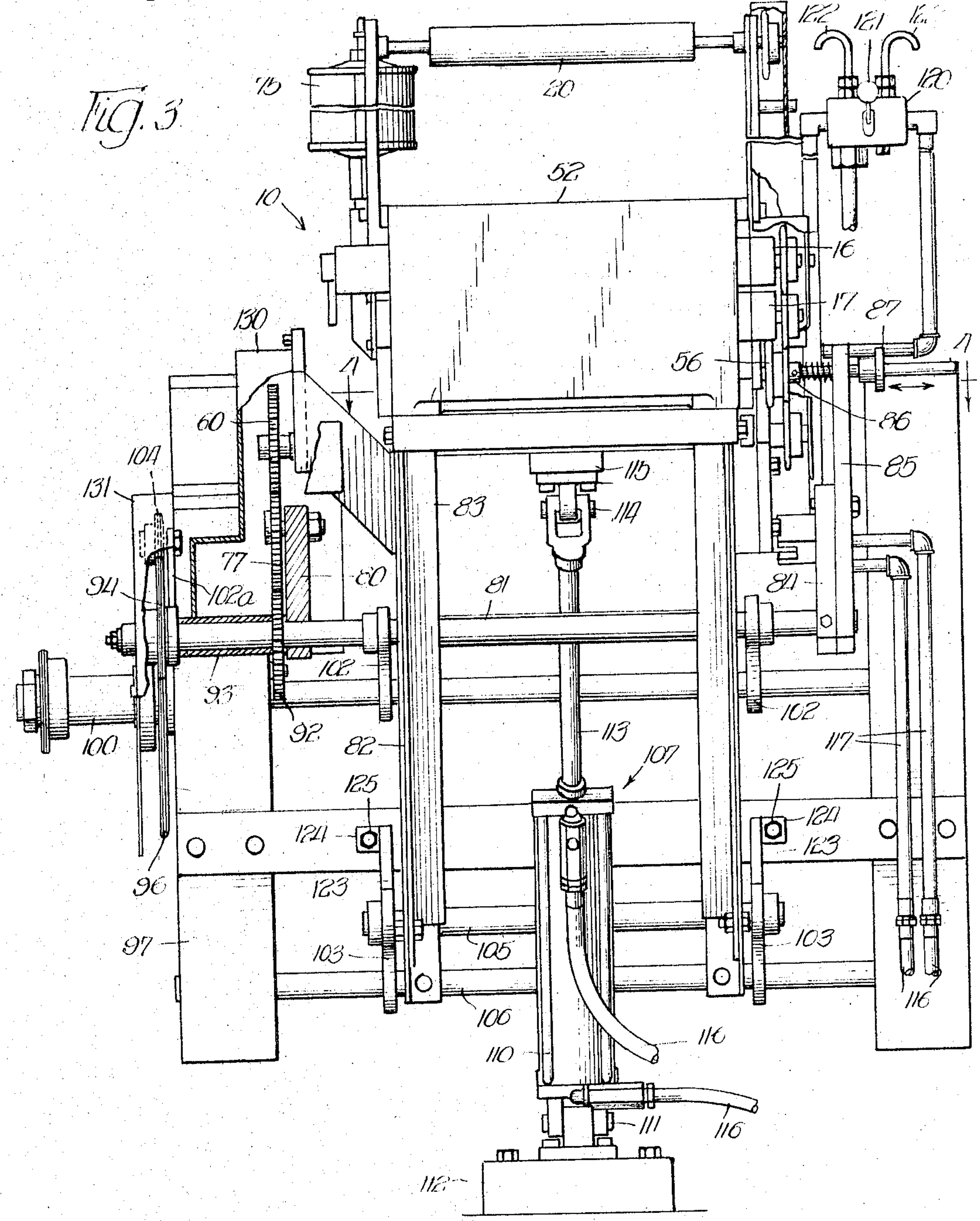
Fig. 3



INVENTORS.
Daniel L. Orloff,
Raymond J. Keating,
By James S. Hu,
Christ, Lockwood, Greenawalt + Dewey, Attys

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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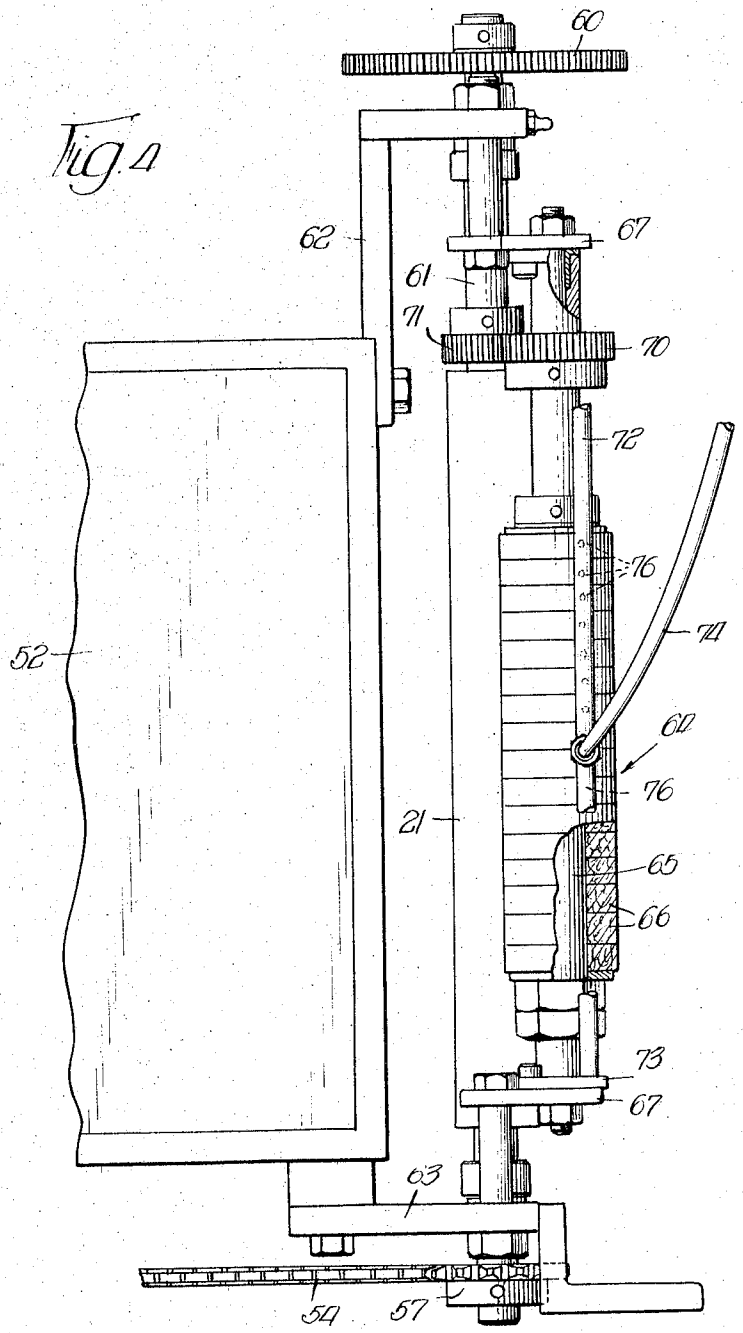
Fig. 4



INVENTORS.
Daniel L. Orloff,
Raymond J. Keating
BY James S. Hu,

Frost, Lockwood, Greenawalt & Dewey
Attys

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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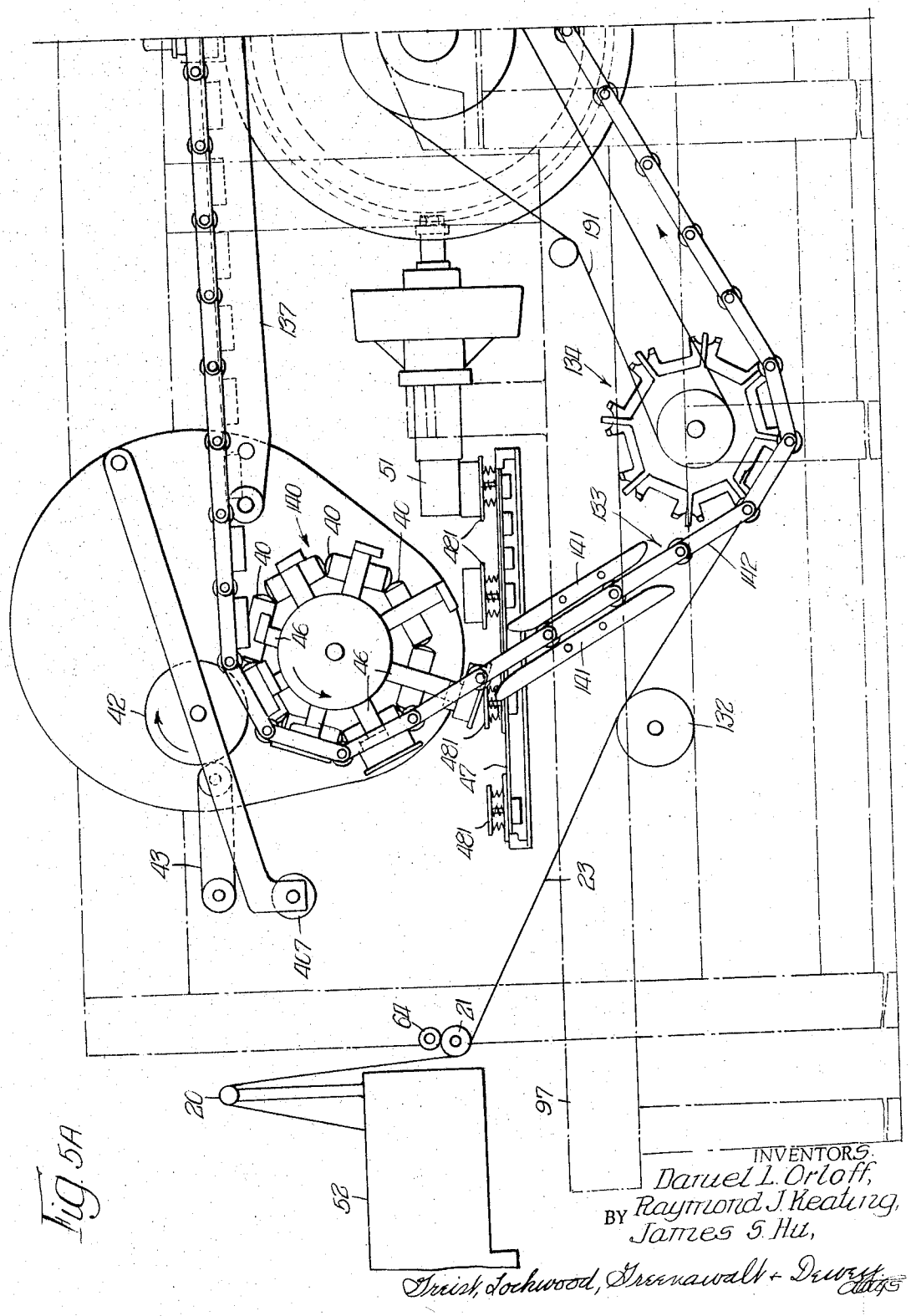

Fig. 5A

INVENTORS.
Daniel L. Orloff,
Raymond J. Keating,
James S. Hu,
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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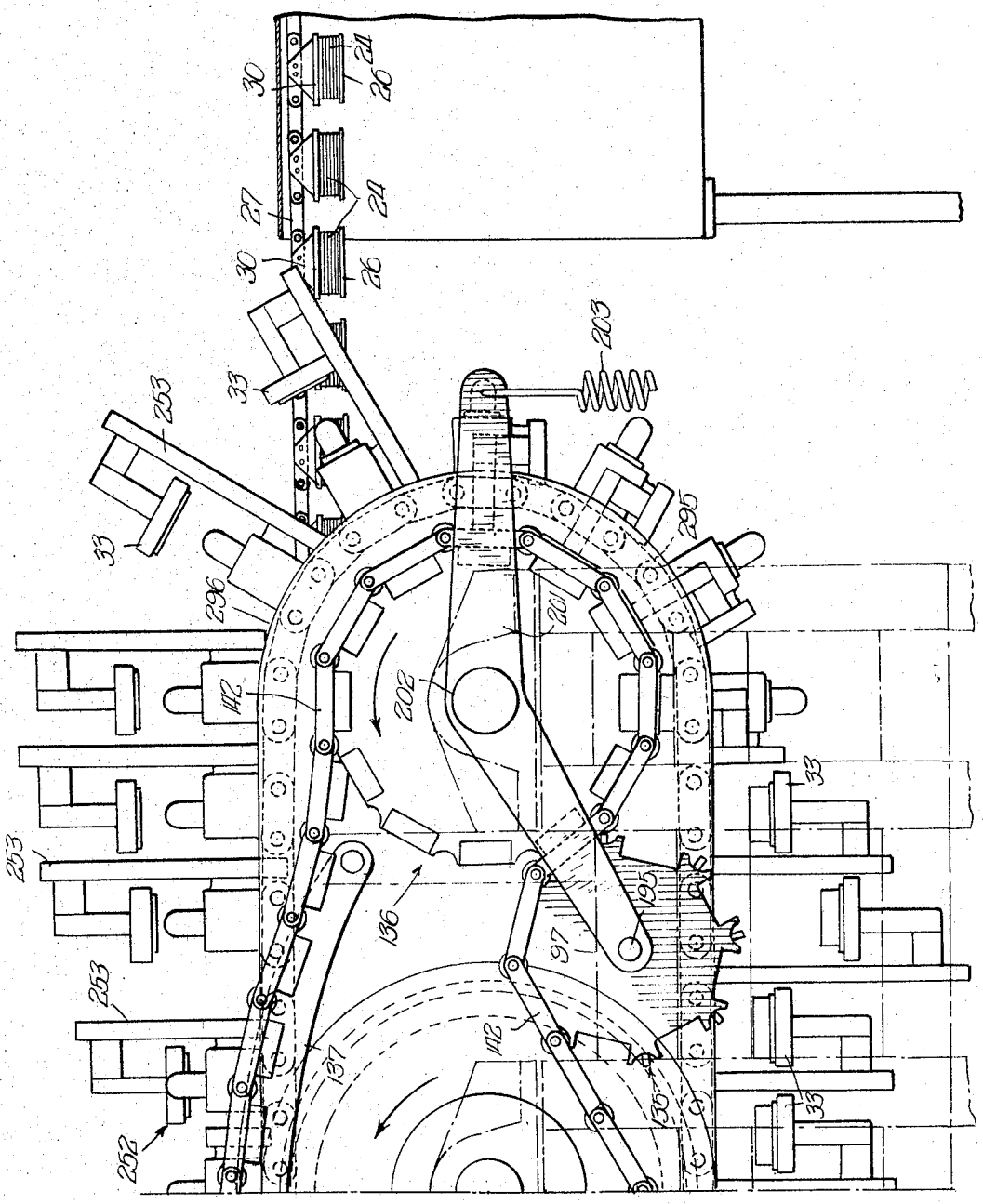

Fig. 5B

INVENTORS
Daniel L. Orloff,
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BY James S. Hu,
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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Fig. 6

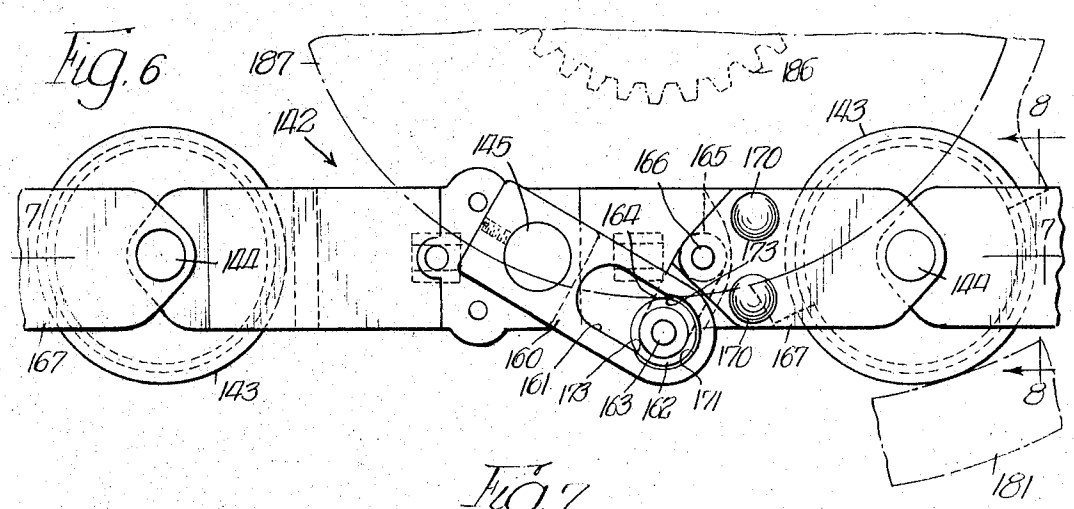
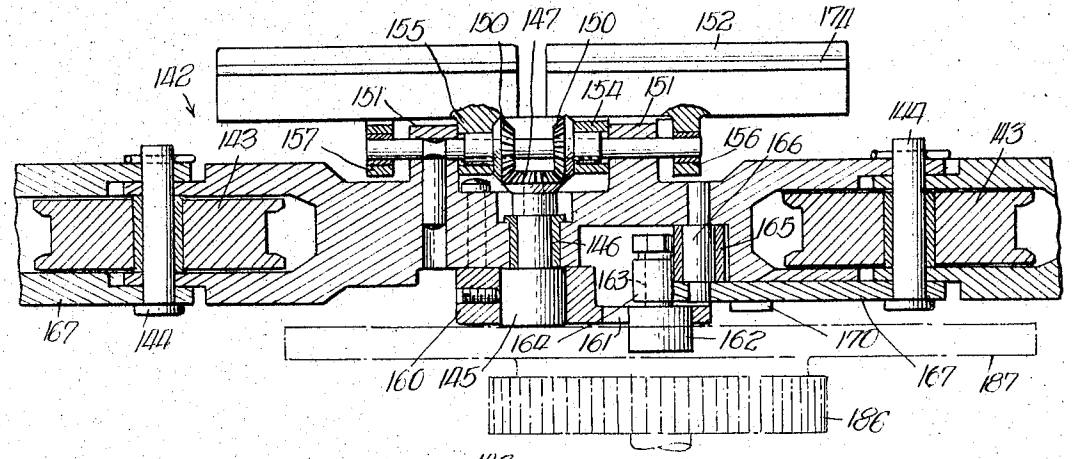


Fig. 7



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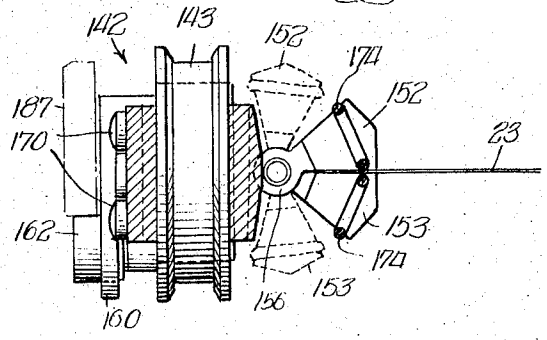

INVENTORS
Daniel L. Orloff.
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BY Grast Lockwood, Greenawalt & Dewey.
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

PACKAGING MACHINE

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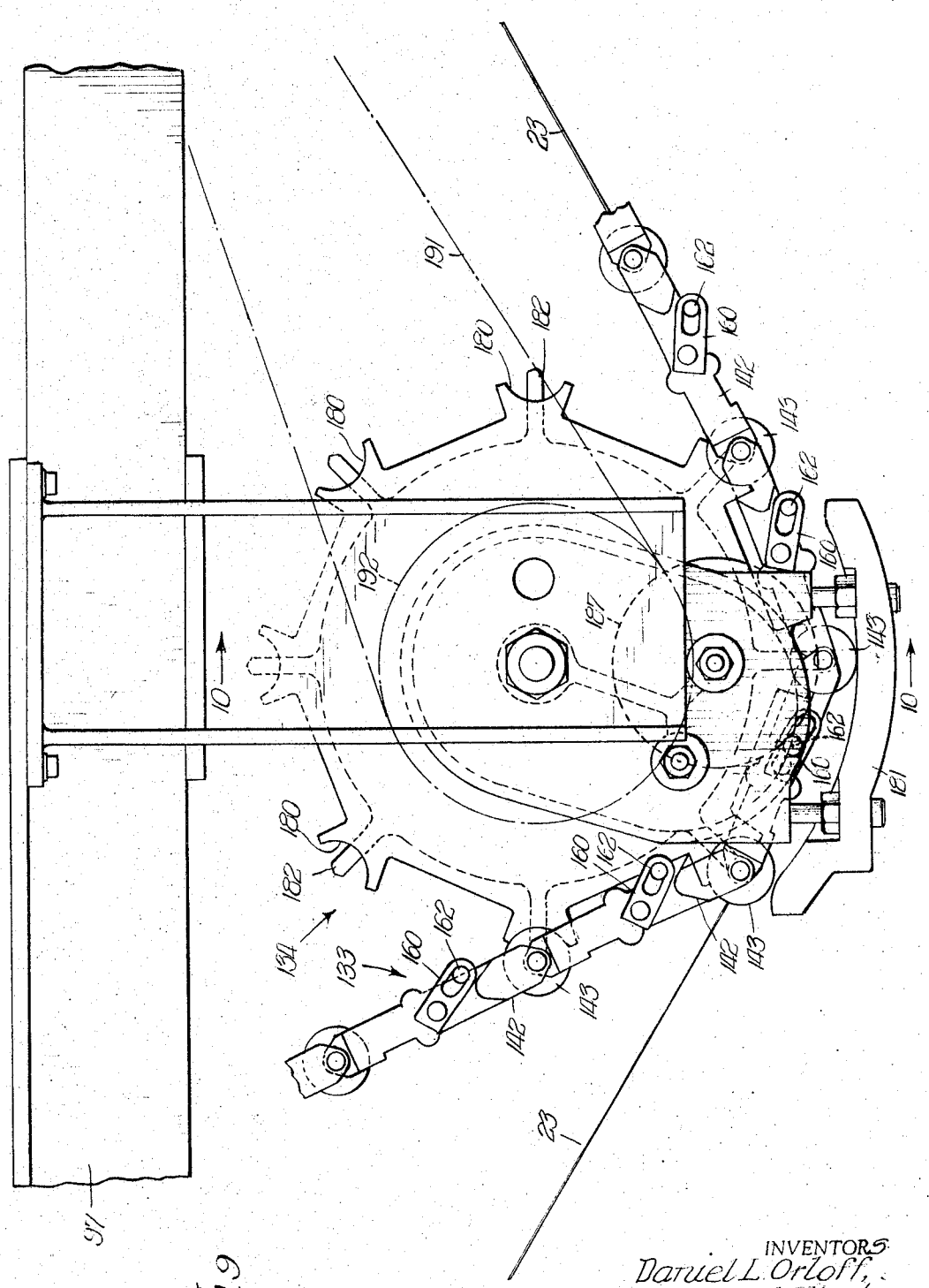

Fig. 9

INVENTORS
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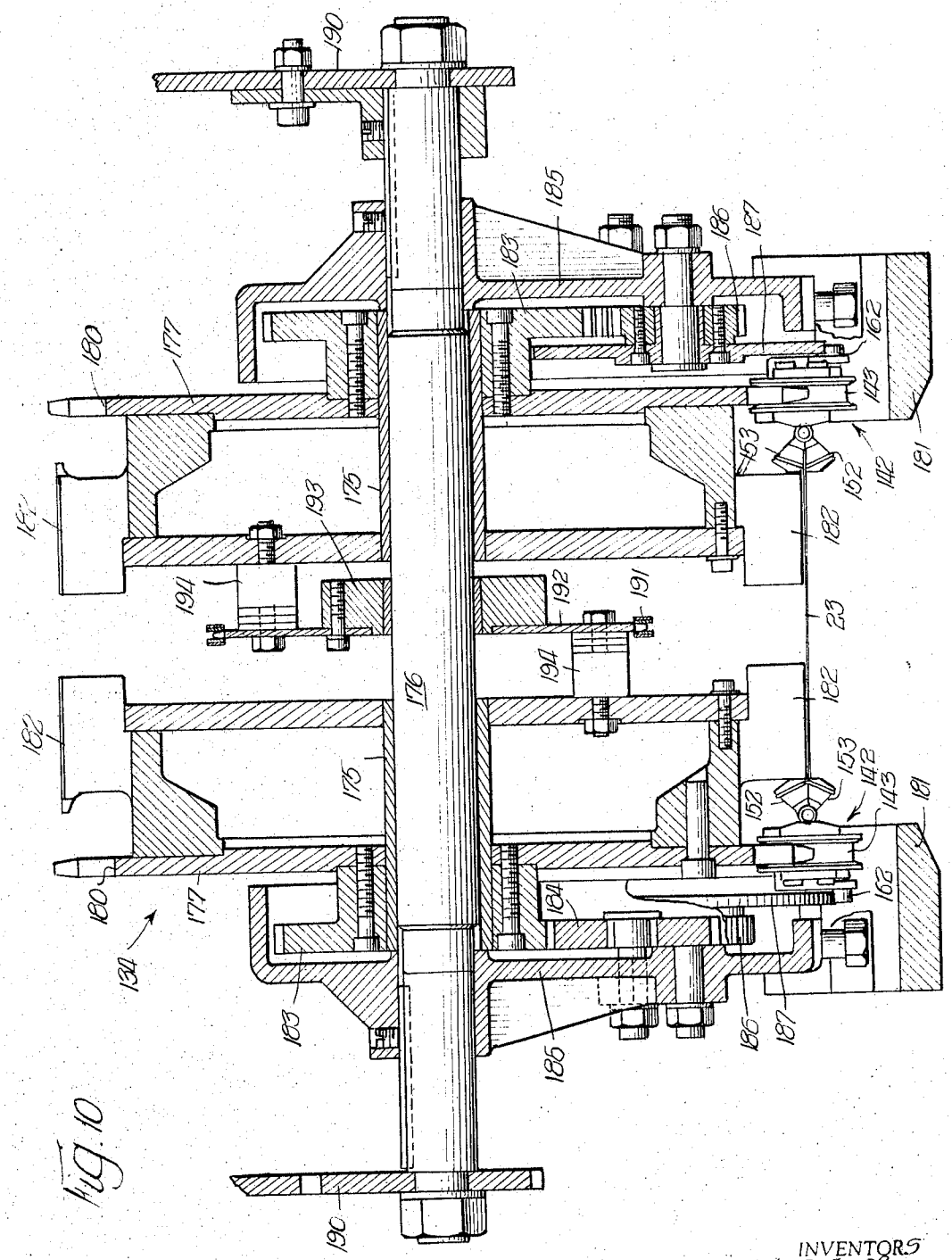

Fig. 10

INVENTORS
Daniel L. Orloff,
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BY
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Fig. 12

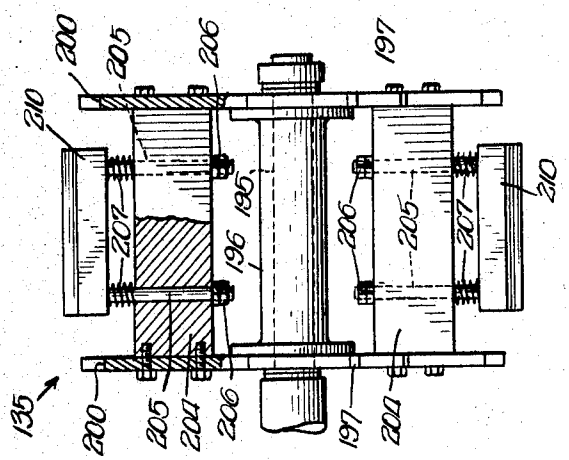
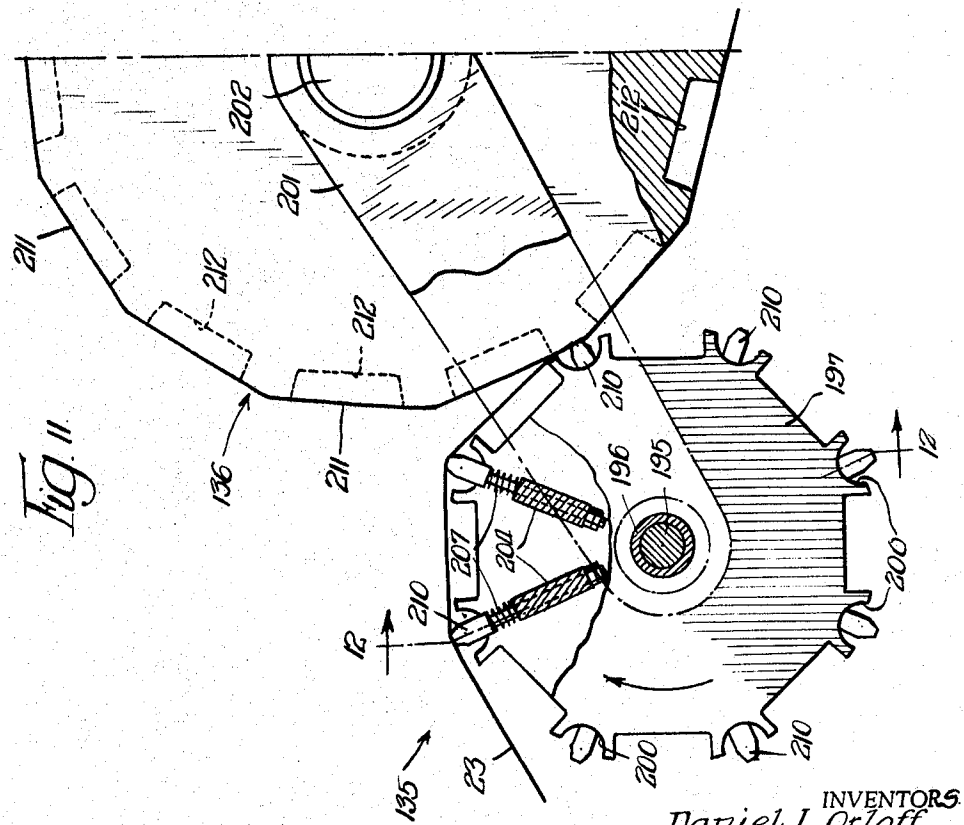


Fig. 11



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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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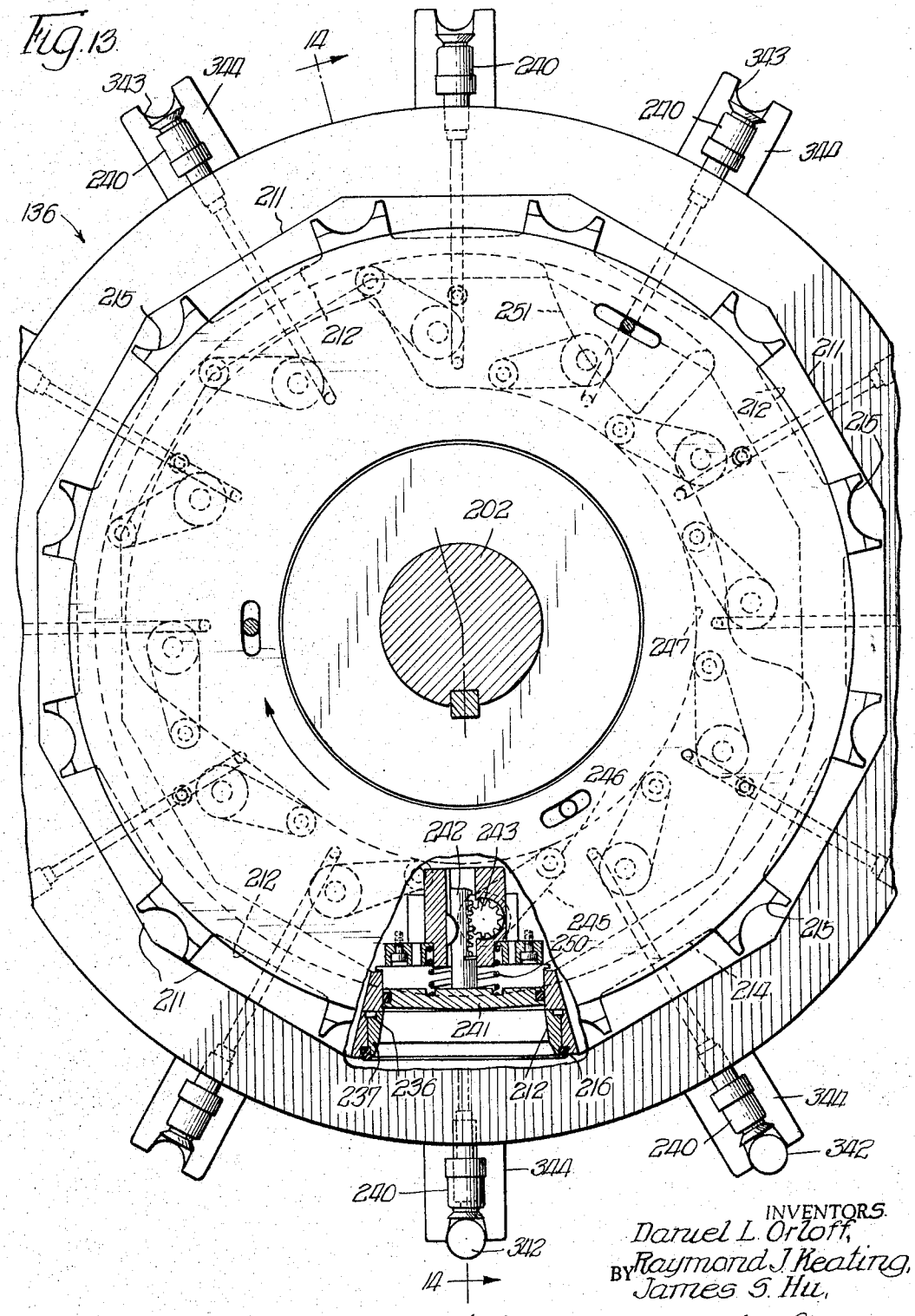
Fig. 13.



INVENTORS.
Daniel L. Orloff,
Raymond J. Keating,
James S. Hu,
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Brush, Lockwood, Greenawalt & Dewey
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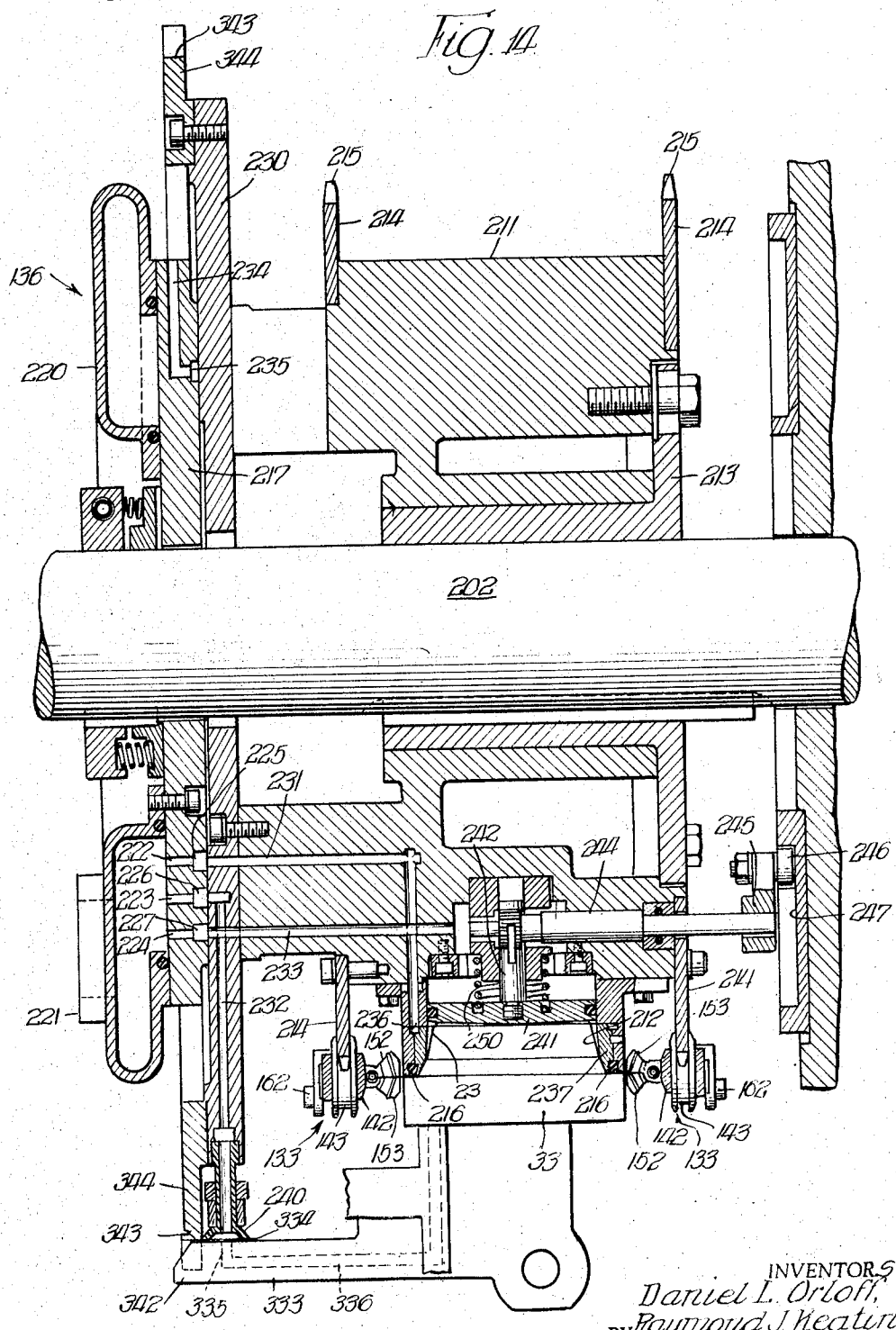
Fig. 14



INVENTORS
Daniel L. Orloff,
Raymond J Keating.
James S. Hu

BY Grist, Lockwood, Greenawalt & Drury

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

PACKAGING MACHINE

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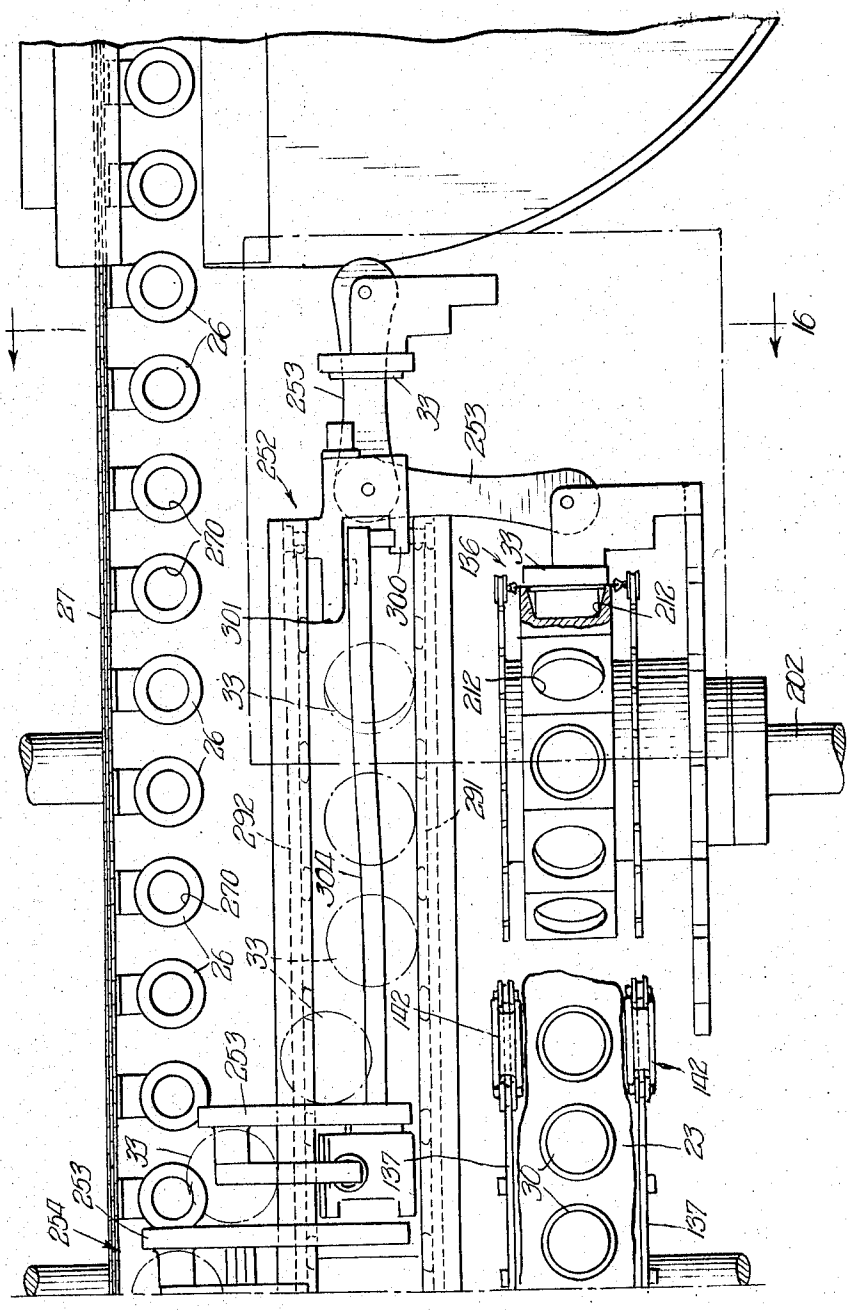

Fig. 15A

INVENTORS
Daniel L. Orloff,
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James S. Hu,
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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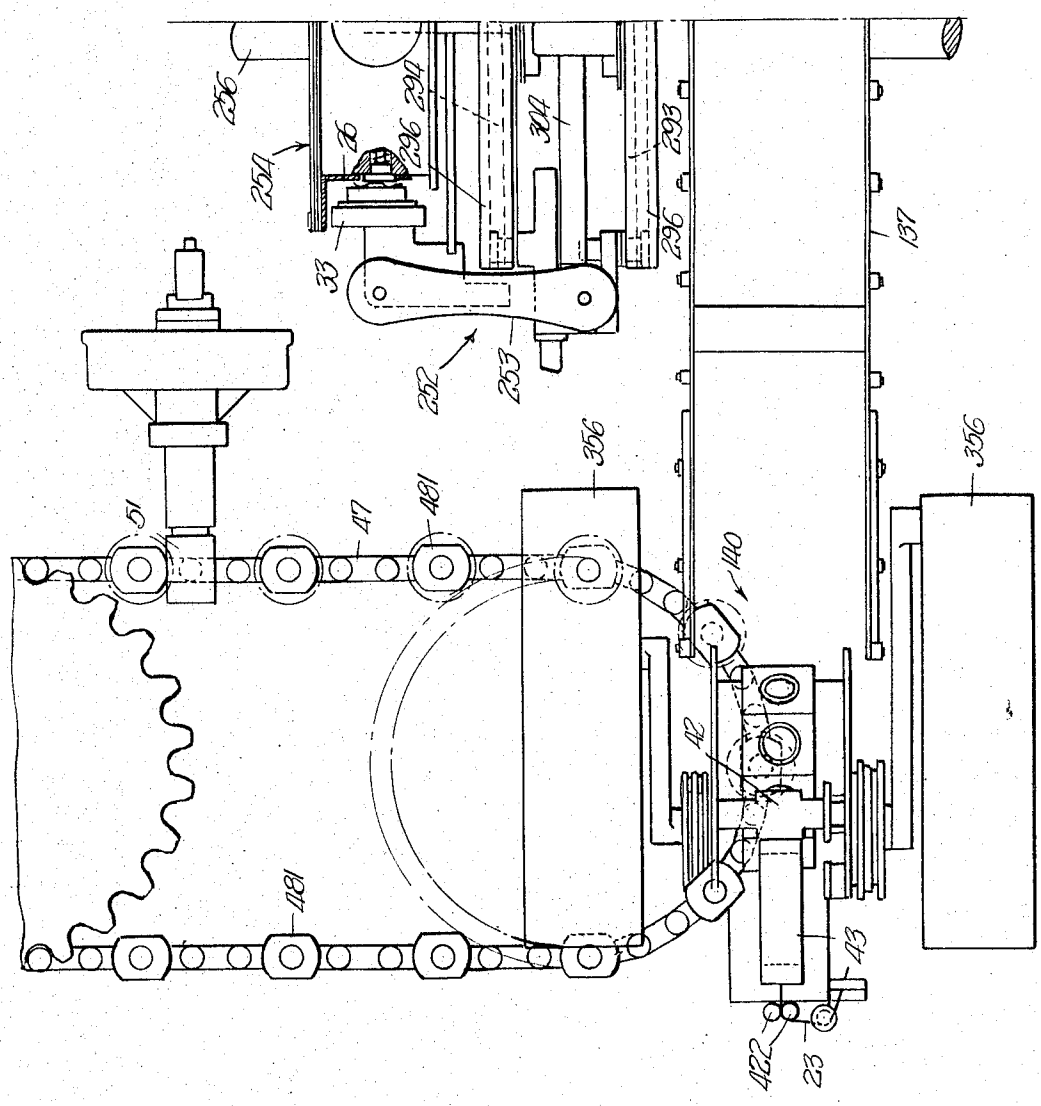

Fig 15B

INVENTORS
Daniel L. Orloff,
Raymond J. Keating,
BY James S. Hu.

Driscoll, Lockwood, Greenawalt & Dewey Attys.

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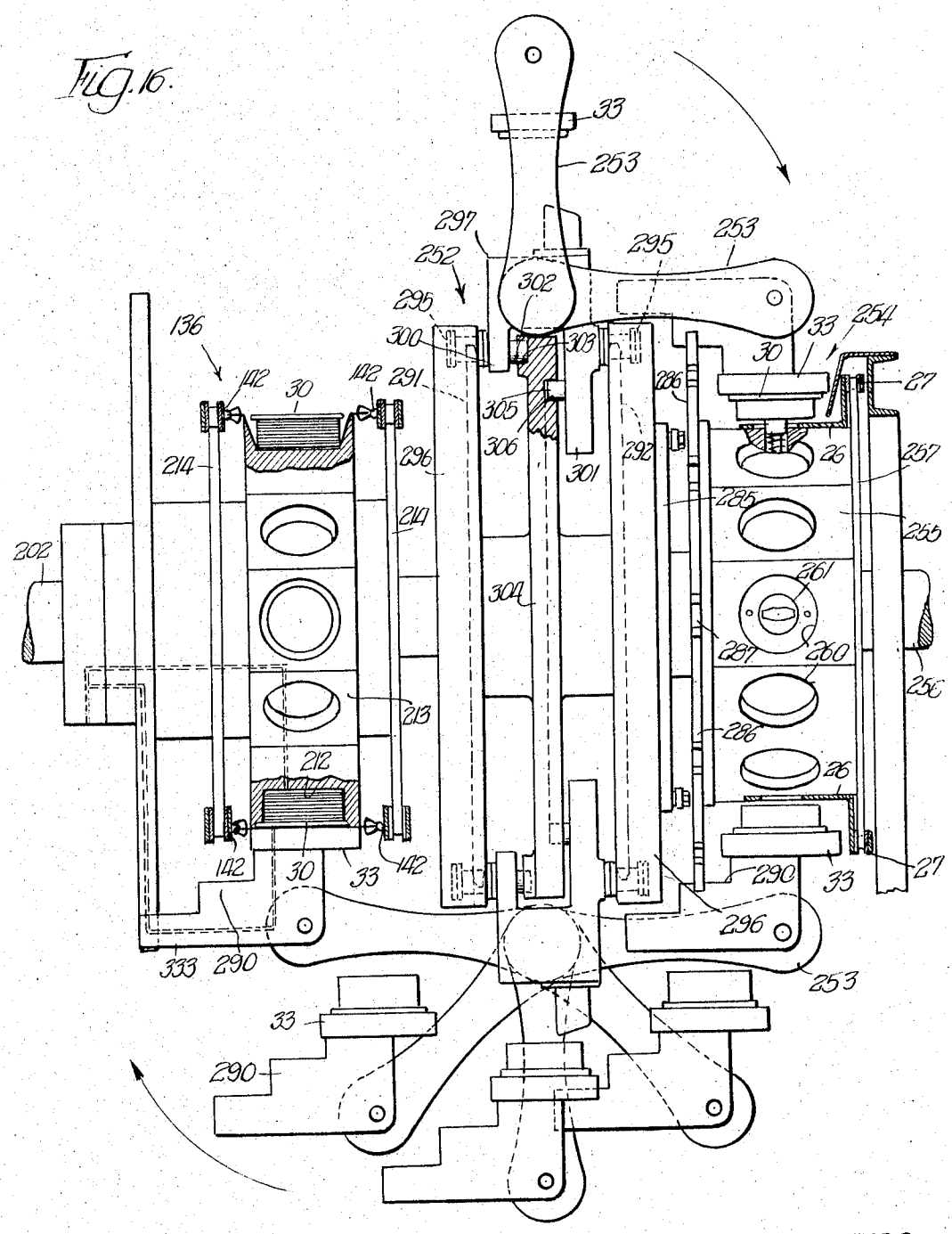
Fig. 16.



INVENTORS
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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Fig 17

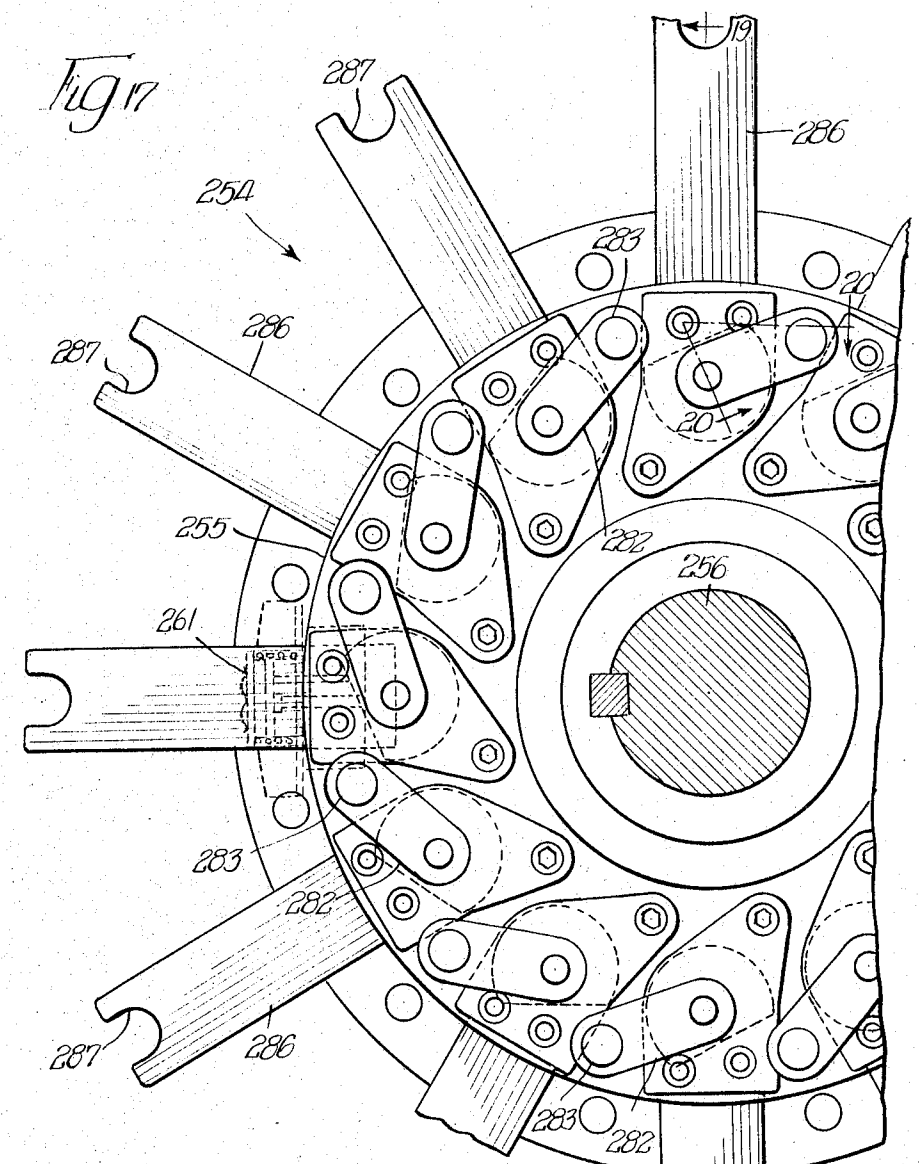
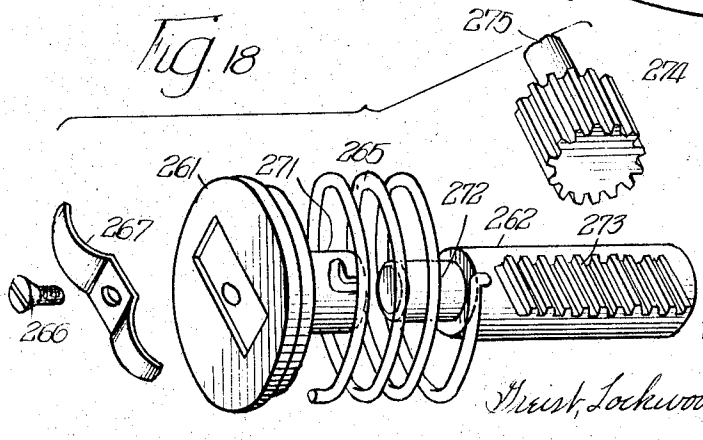


Fig 18



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Raymond J. Keating
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BY Frost, Lockwood, Grunewald & Dewey
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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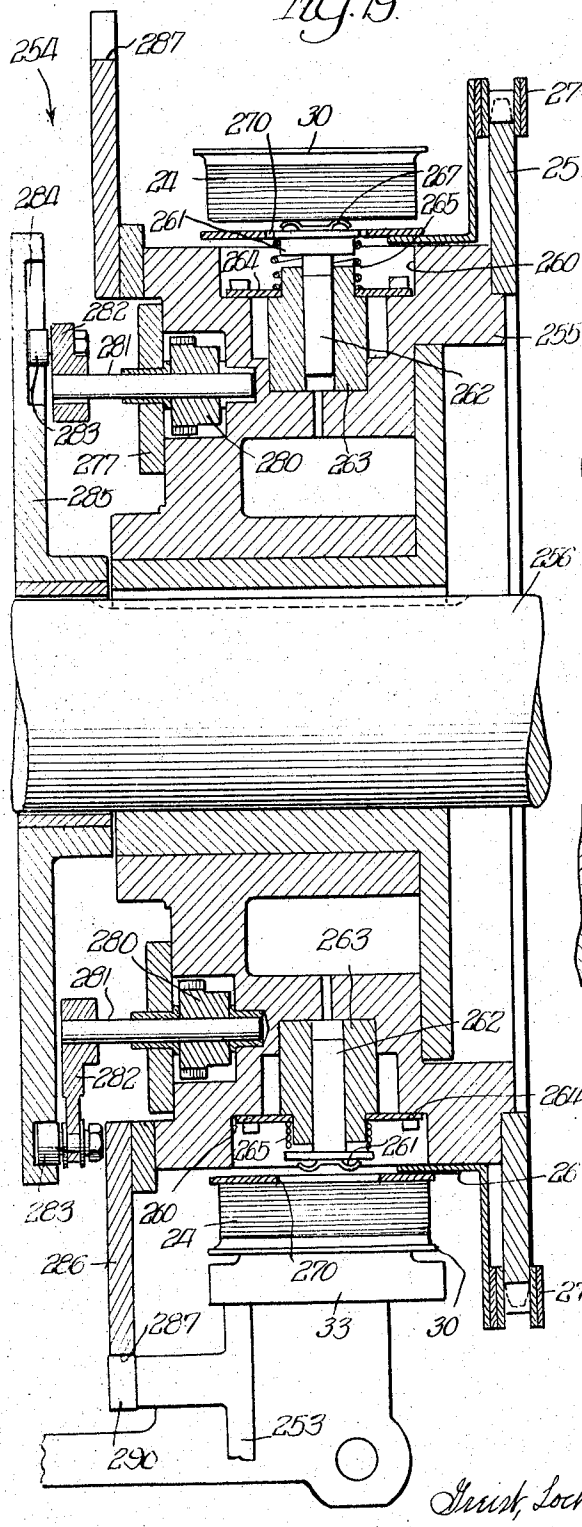
Fig. 19.



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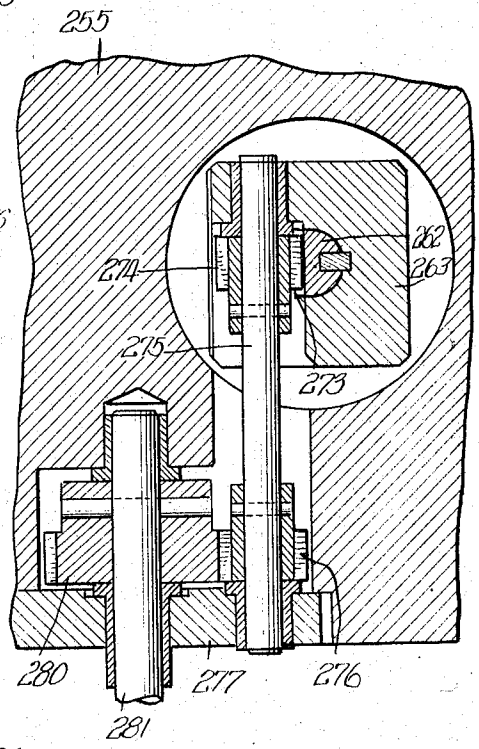

INVENTORS
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BY James S. Hu,
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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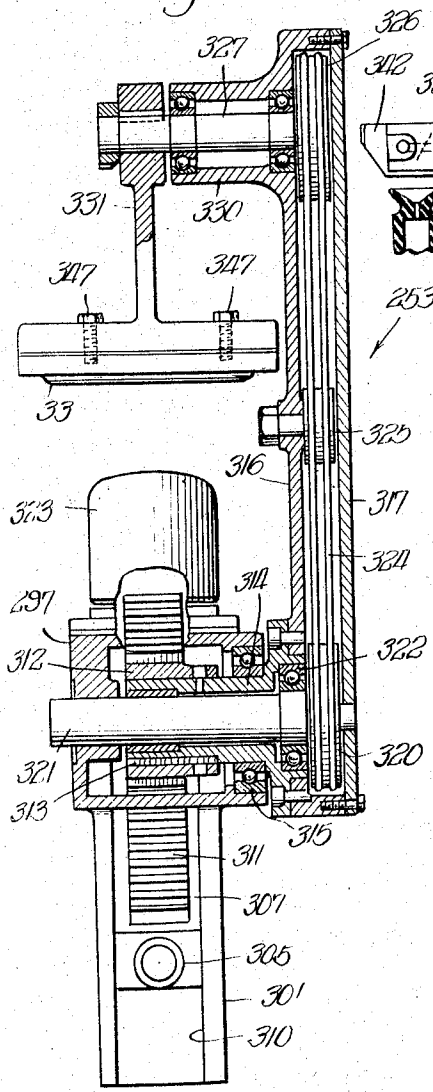
Fig. 22



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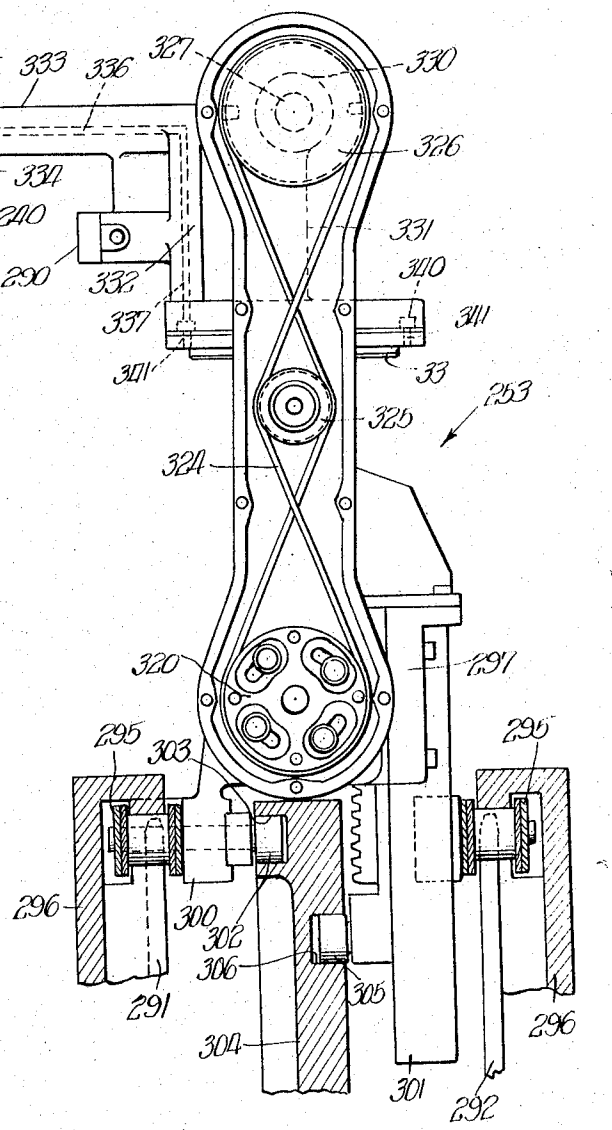

INVENTORS.
Daniel L. Orloff,
Raymond J. Keating,
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Jan. 24, 1967 D. L. ORLOFF ET AL 3,299,608

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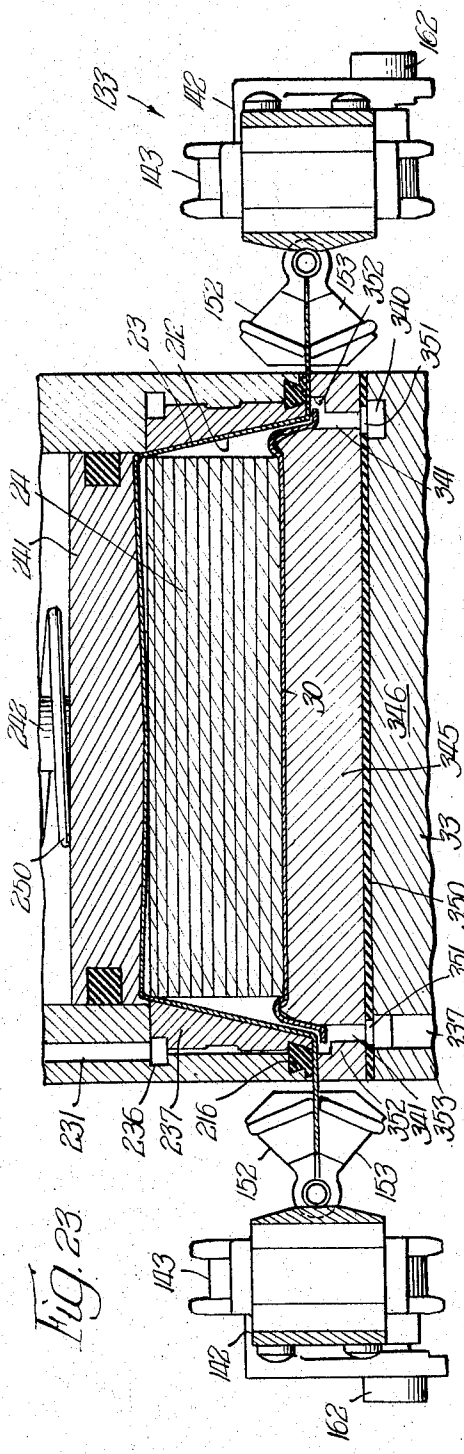

Fig. 23

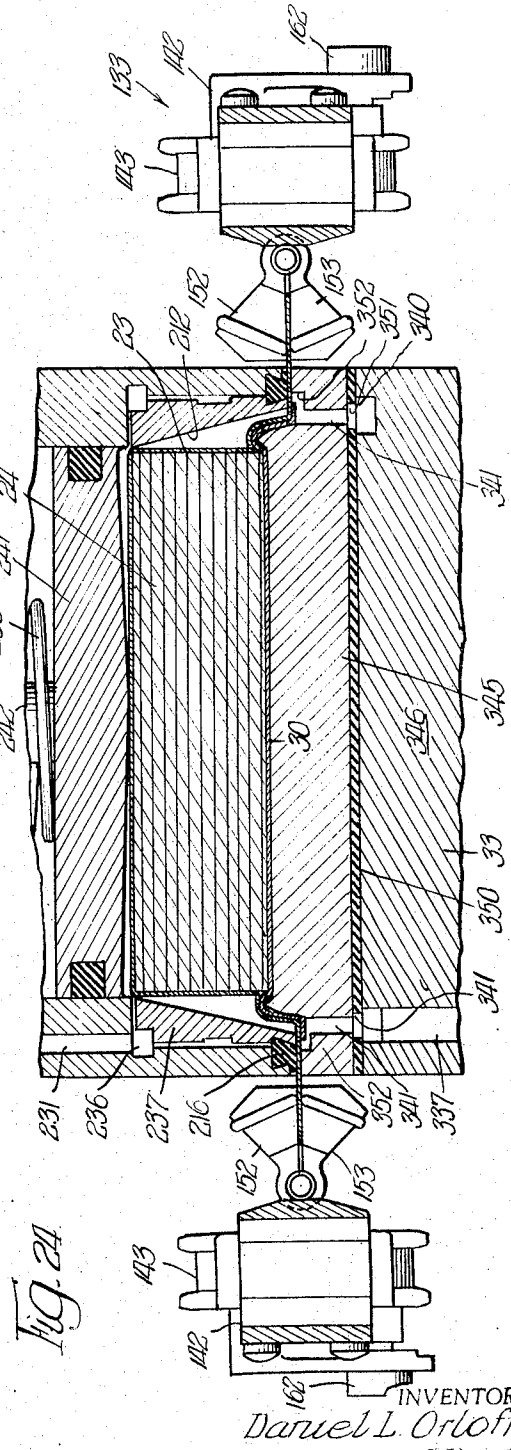

Fig. 24

INVENTORS.
Daniel L. Orloff,
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James S. Hu,
Grust, Lockwood Greenawalt & Druggs
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Jan. 24, 1967 D. L. ORLOFF ET AL 3,299,608

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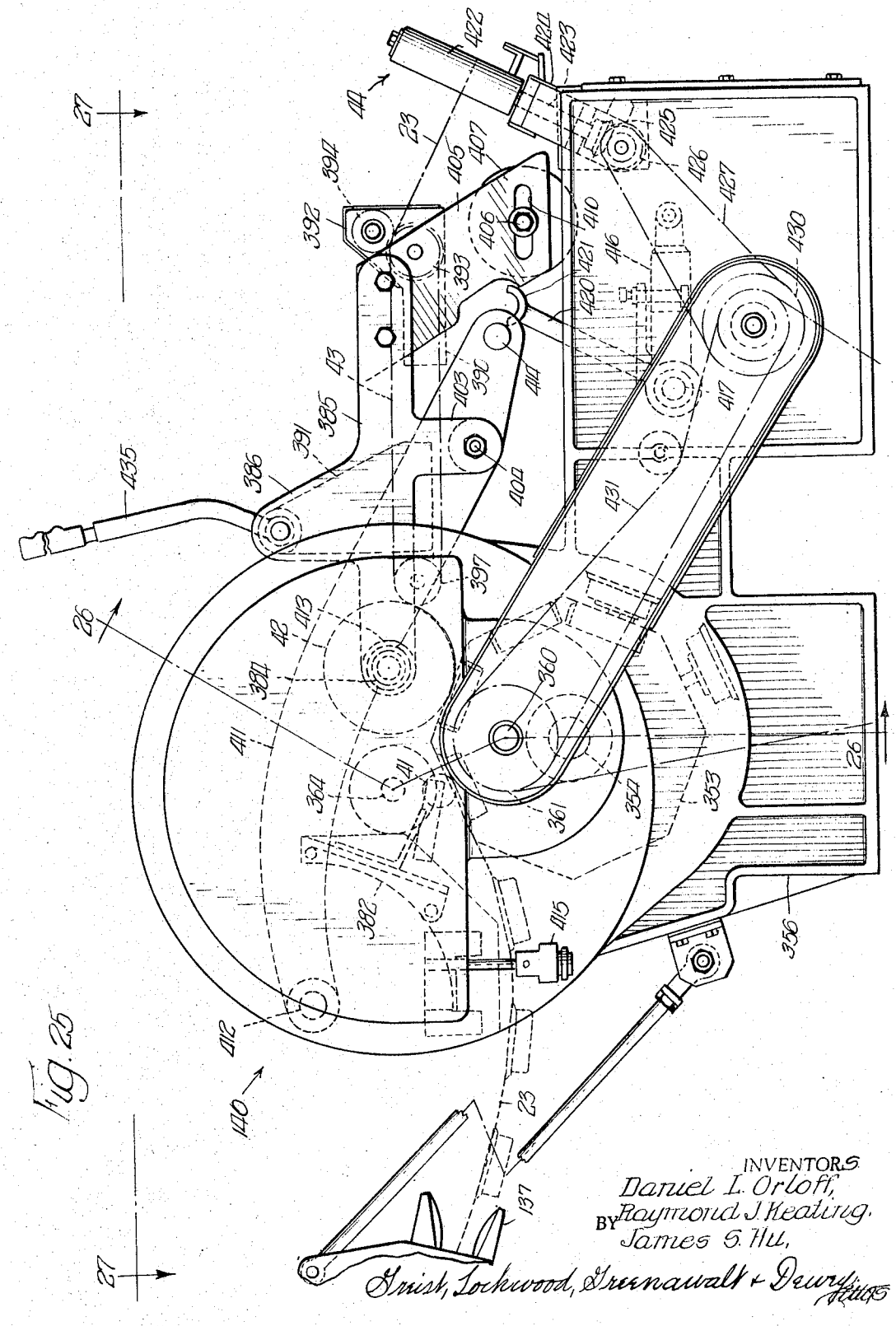

Fig. 25

INVENTORS
Daniel L. Orloff,
Raymond J. Keating,
James S. Hu,
BY
Grish, Lockwood, Greenawalt & Dewey
Attys

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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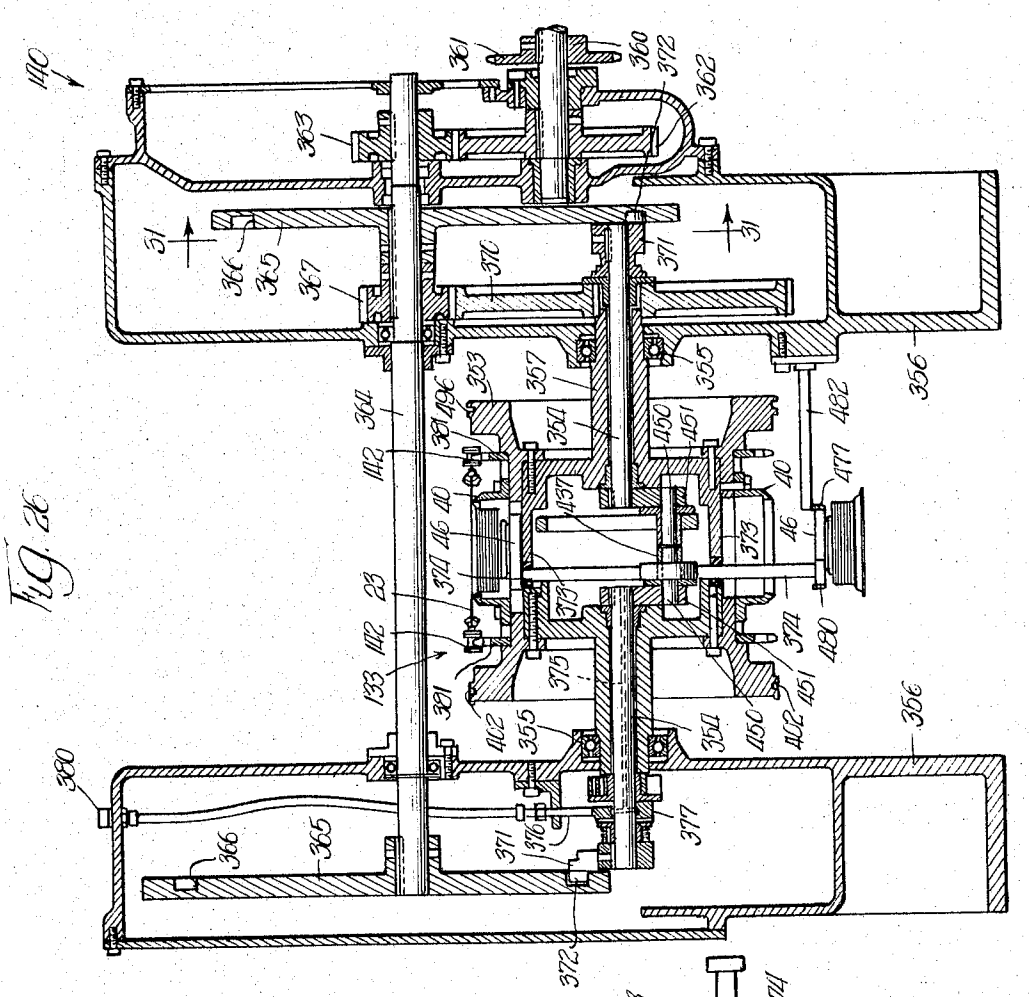
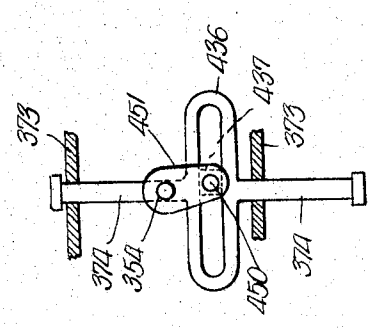


Fig. 26



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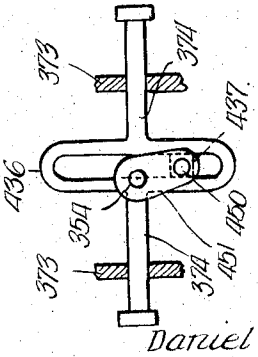

Fig. 33

INVENTORS
Daniel L. Orloff,
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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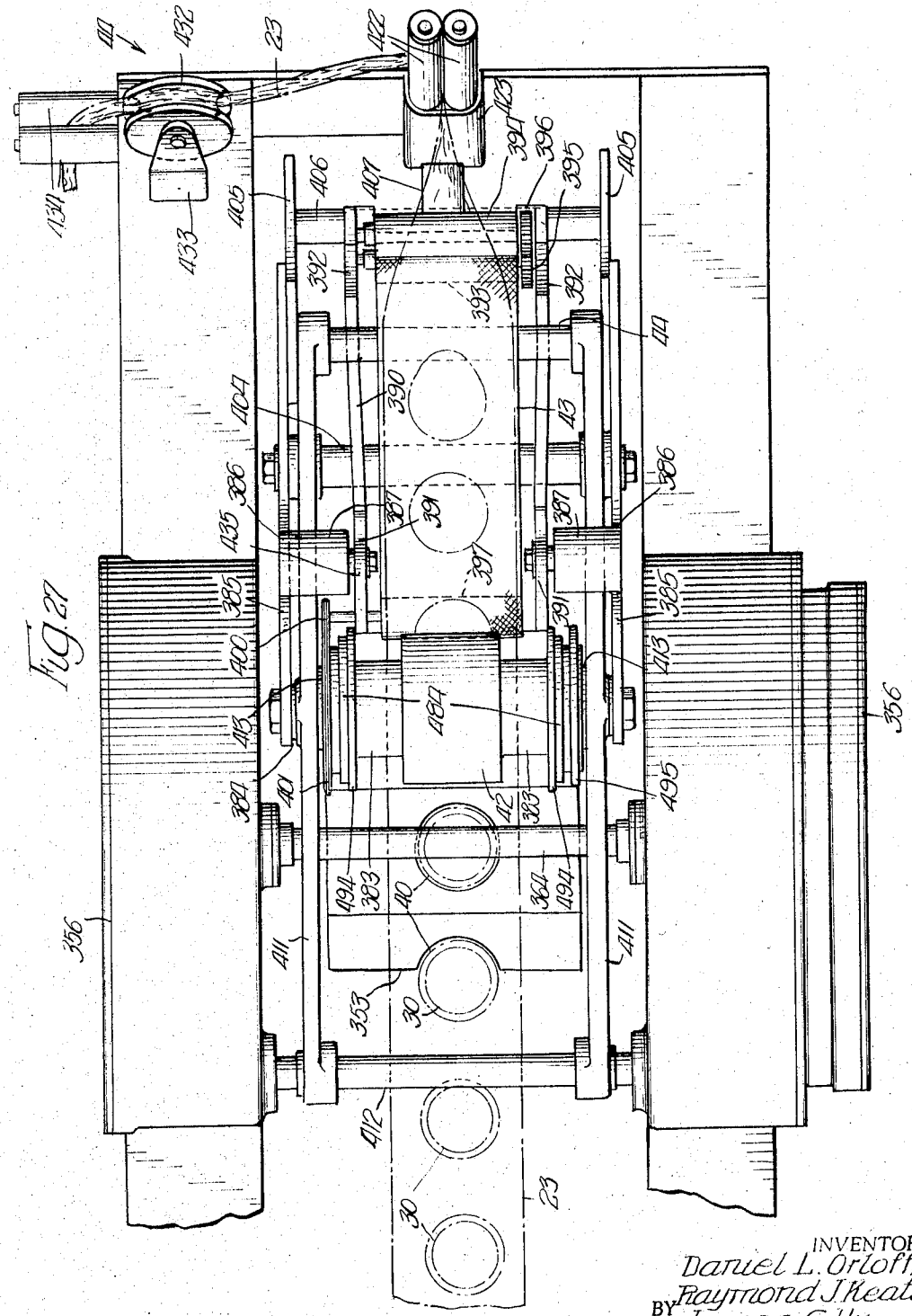

Fig. 27

INVENTORS
Daniel L. Orloff,
Raymond J. Keating,
James S. Hu,
BY Grist, Lockwood, Greenawalt, & Dewey
Attys

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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Fig. 28

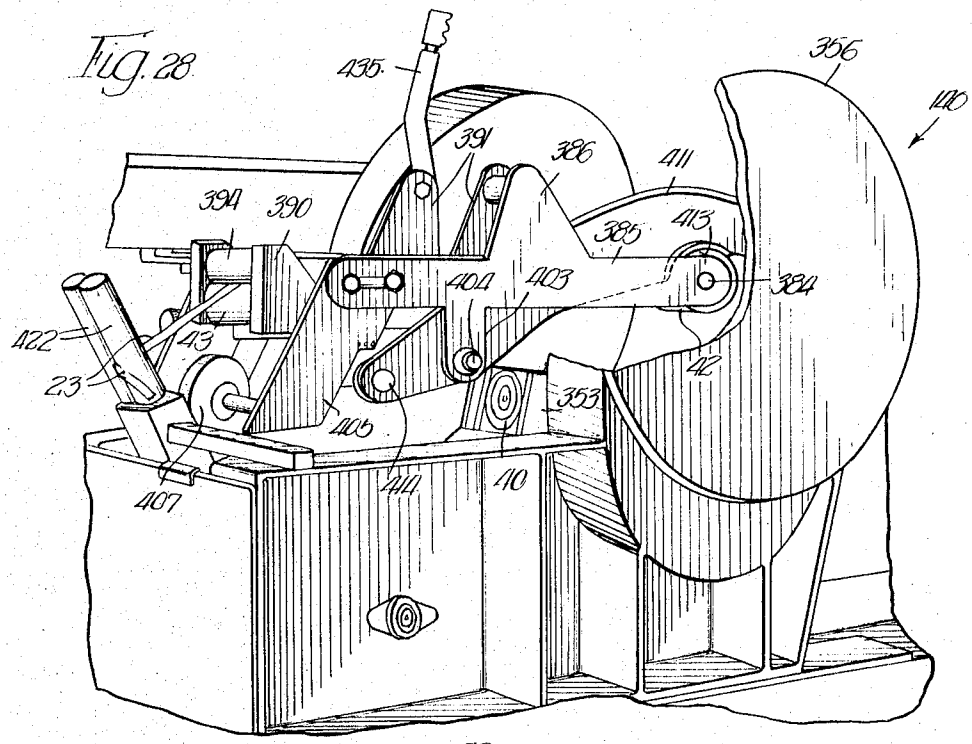
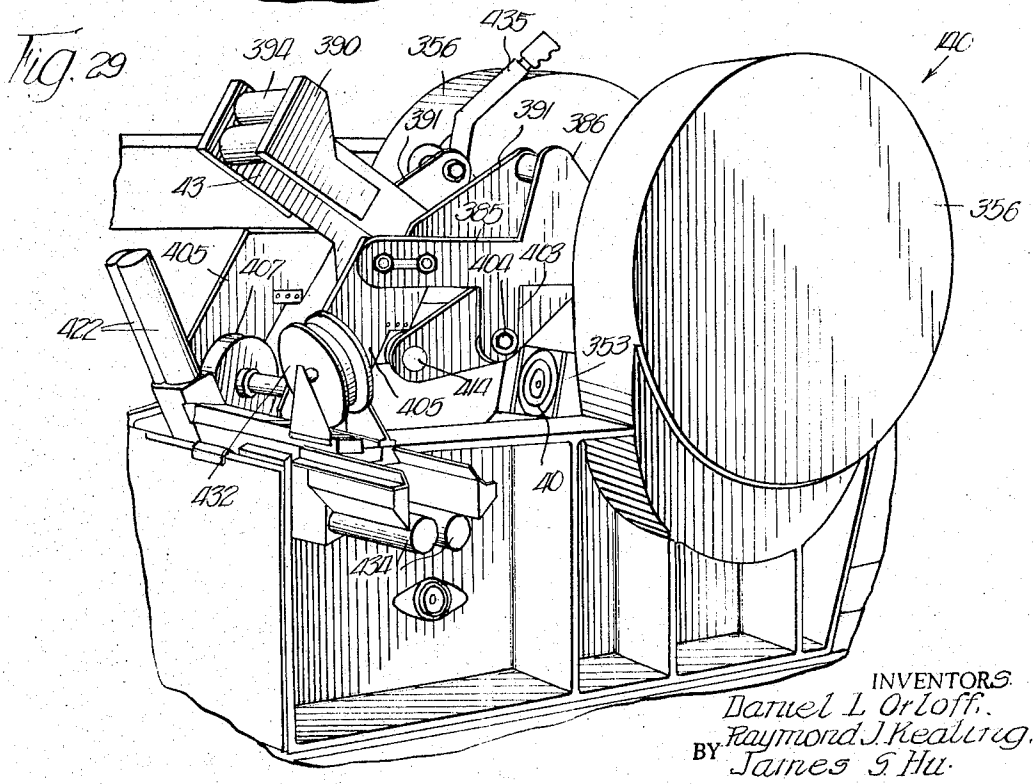


Fig. 29



INVENTORS.
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Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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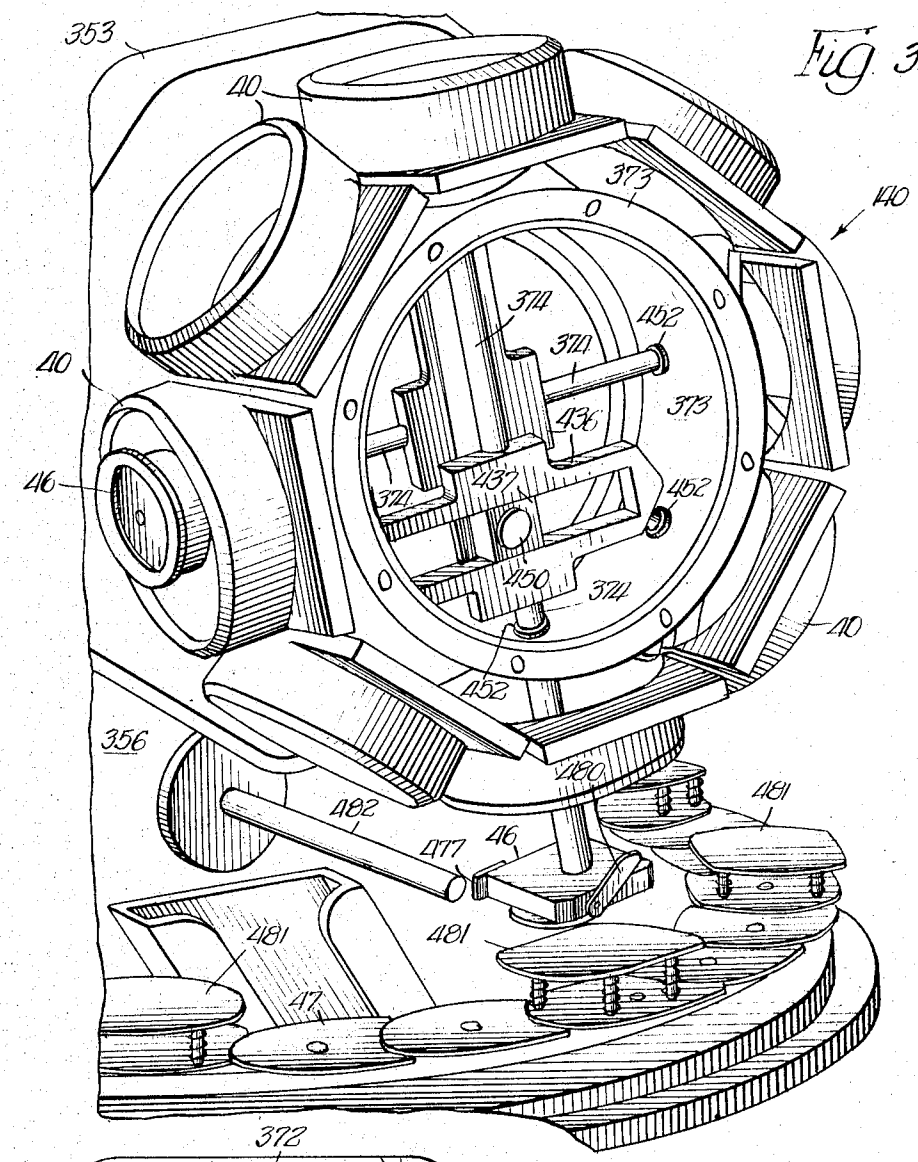

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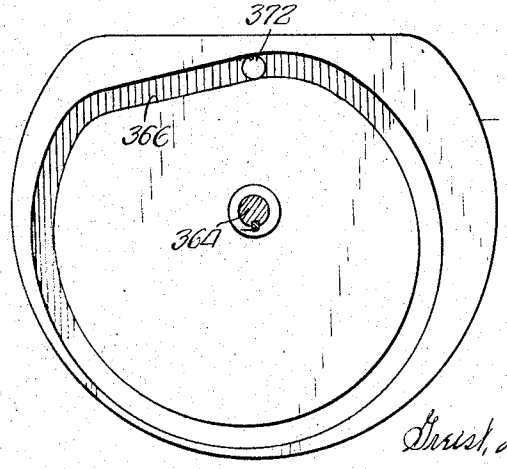

Fig. 31.

INVENTORS.
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James S. Hu.

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Attys

Jan. 24, 1967 D. L. ORLOFF ETAL 3,299,608

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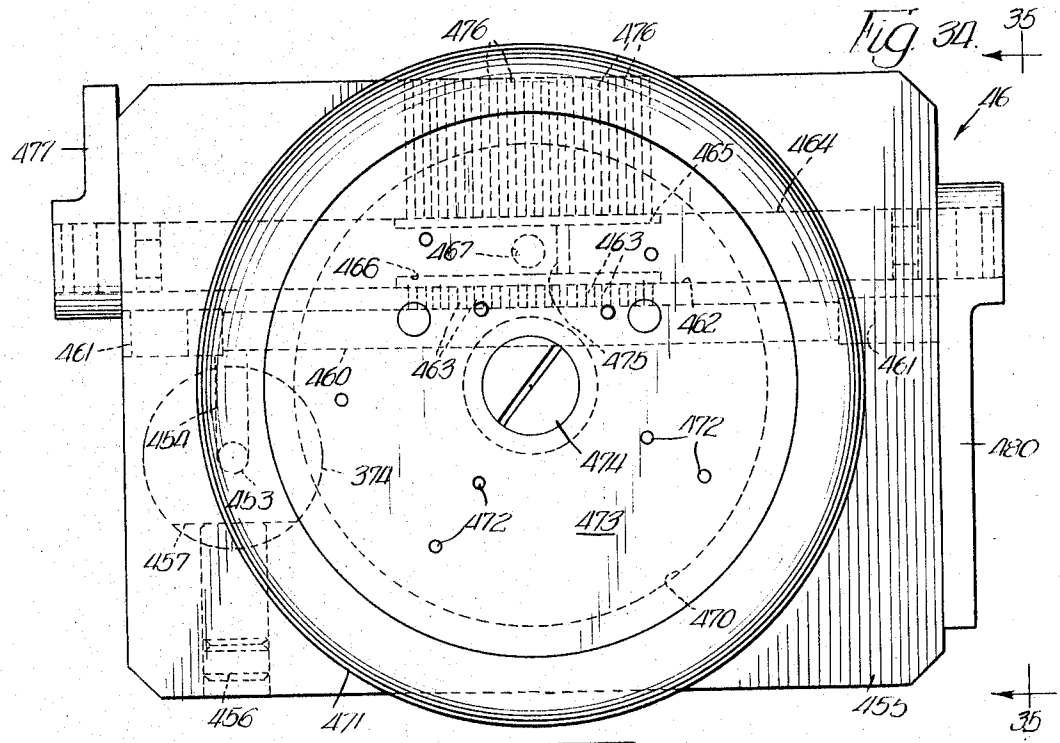
Fig. 34.



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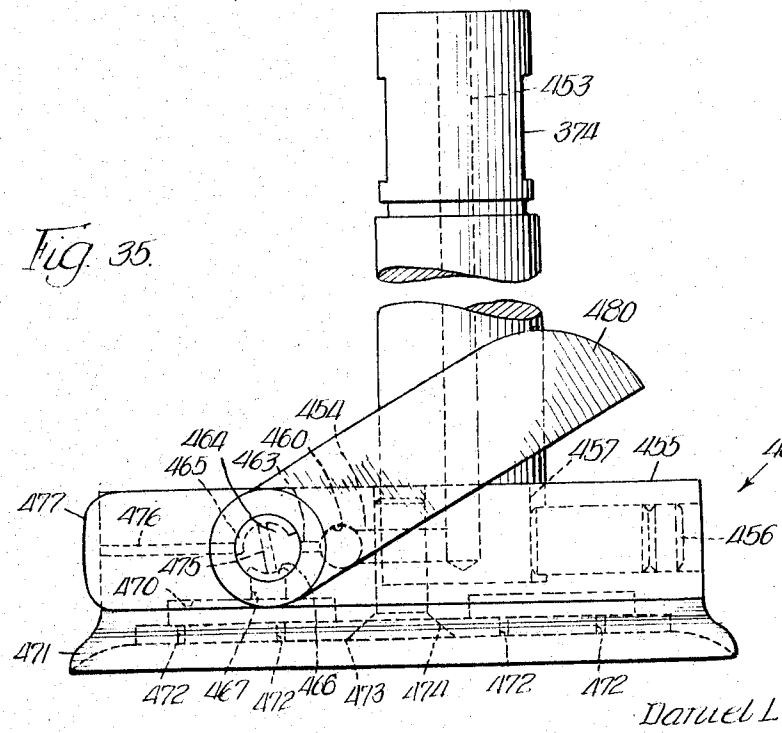

INVENTORS
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Attys

PACKAGING MACHINE

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Fig. 36

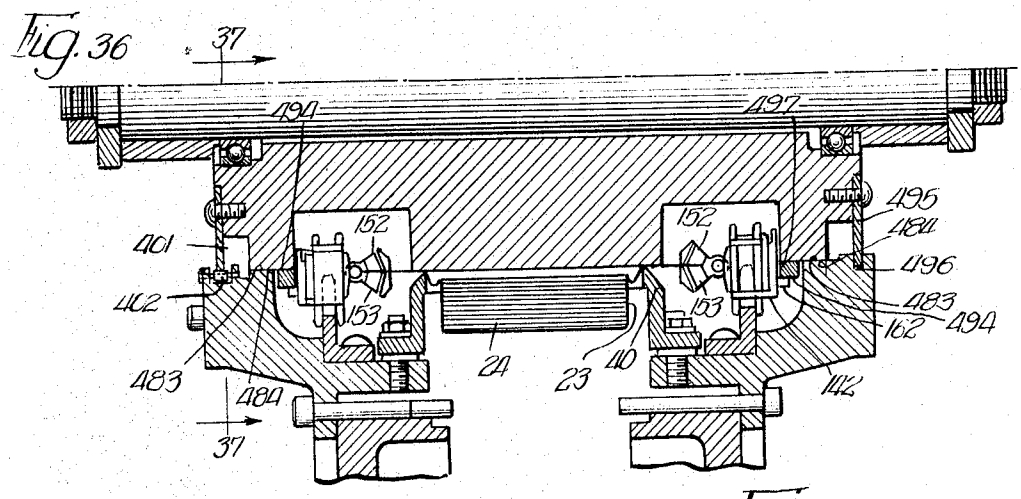
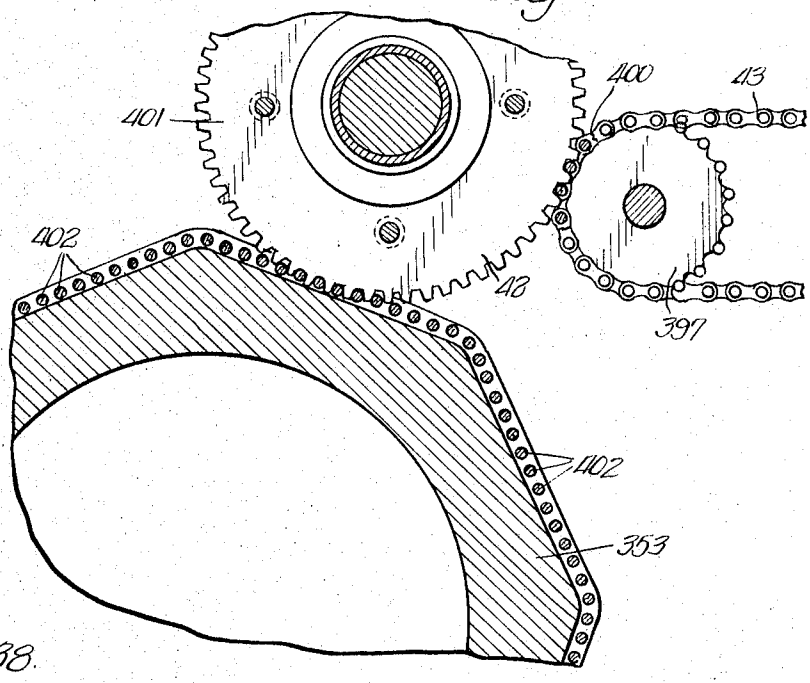


Fig. 37



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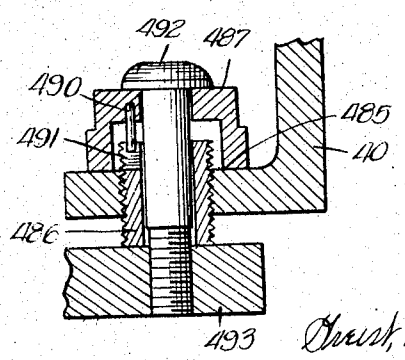

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BY Raymond J. Keating,
James S. Hu,
Brisk, Lockwood, Brumwalt & Dewey Attys

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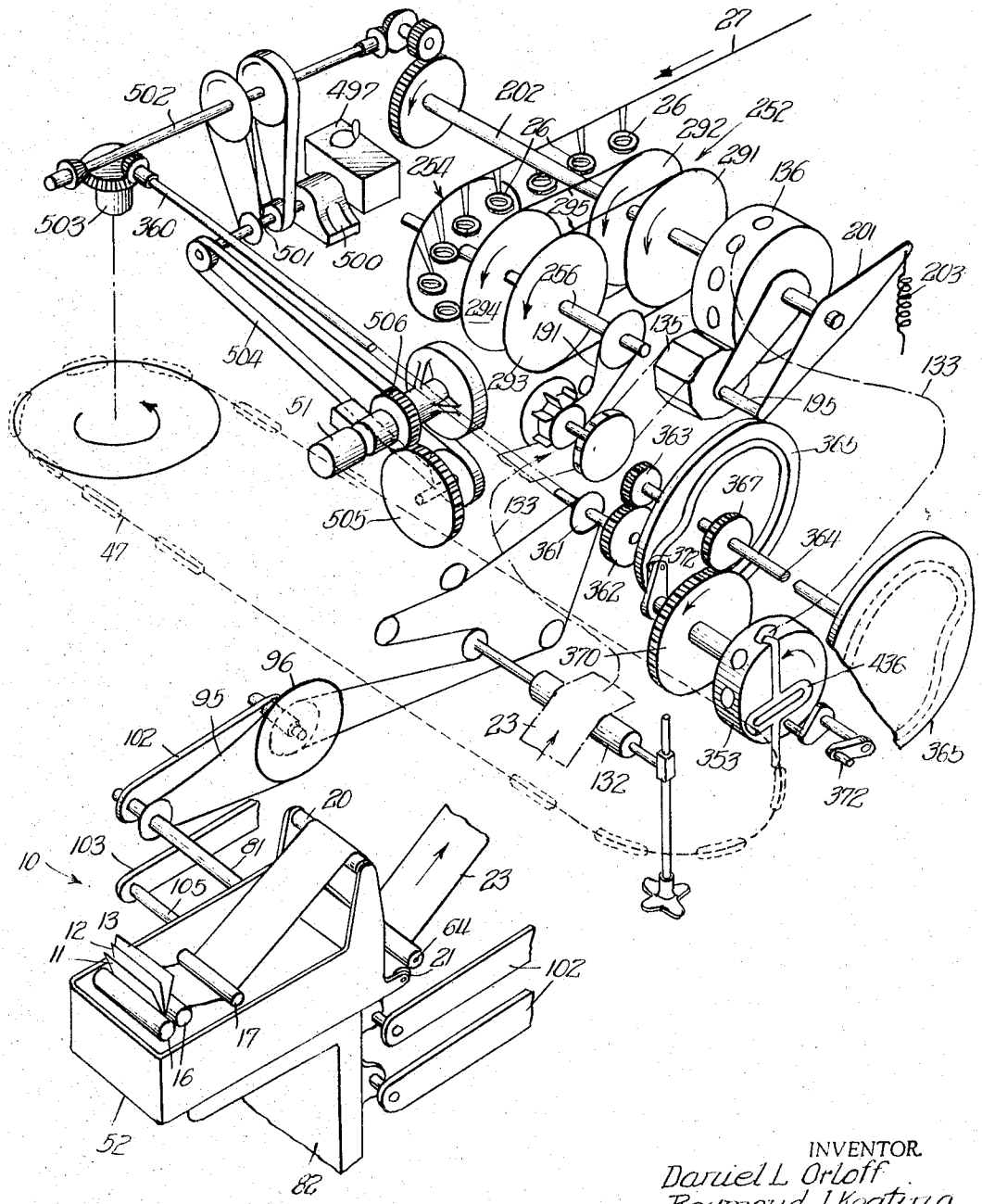
Fig. 39



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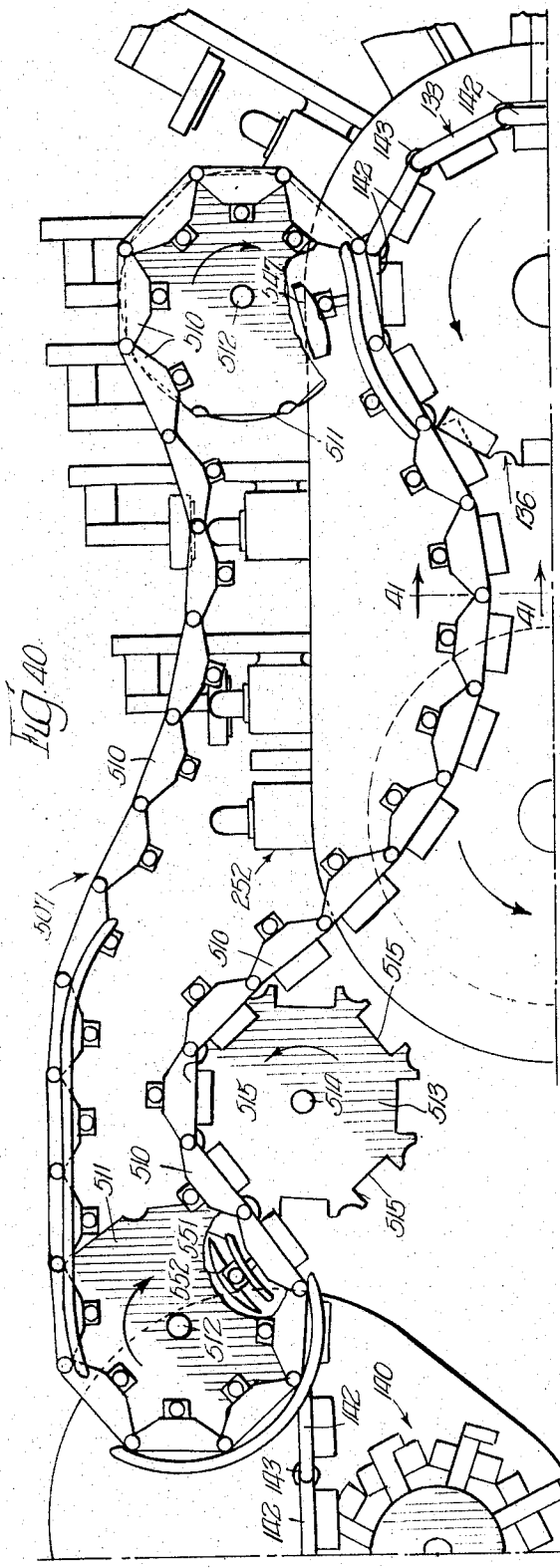

Fig. 40

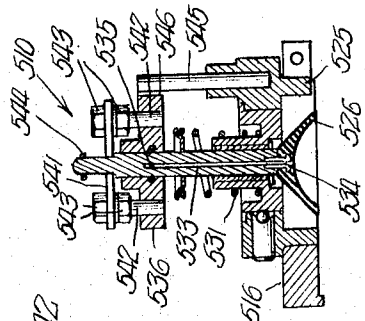

Fig. 42

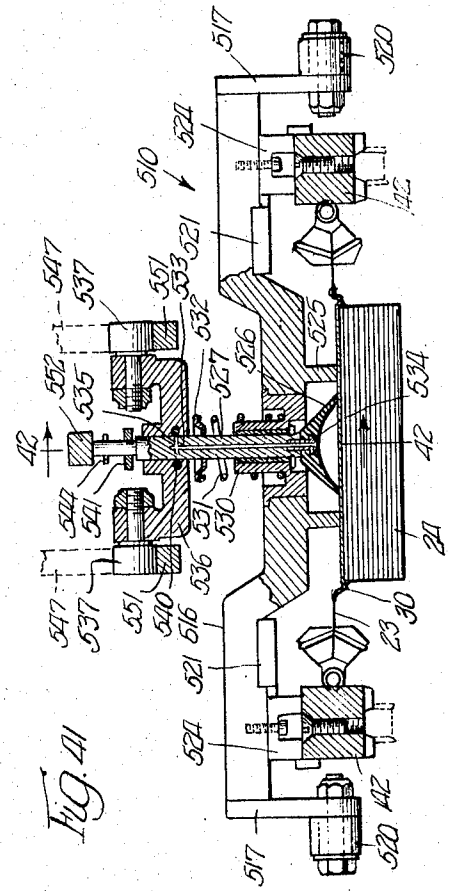

Fig. 41

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PACKAGING MACHINE

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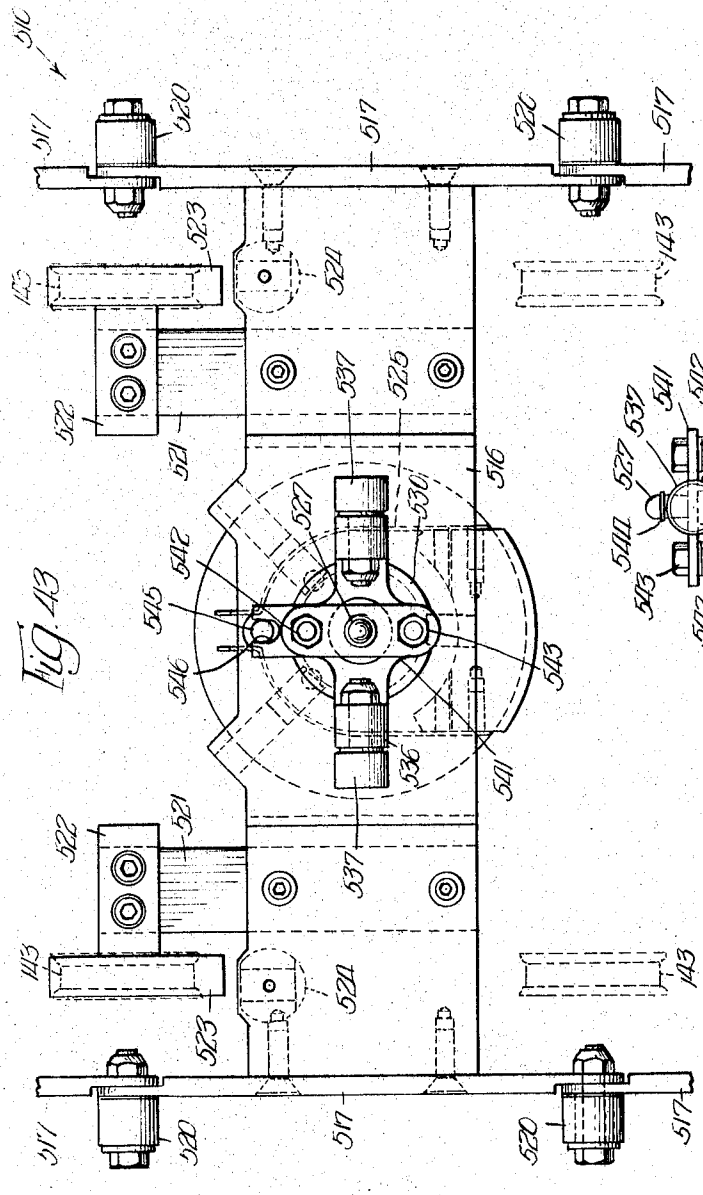

Fig. 43

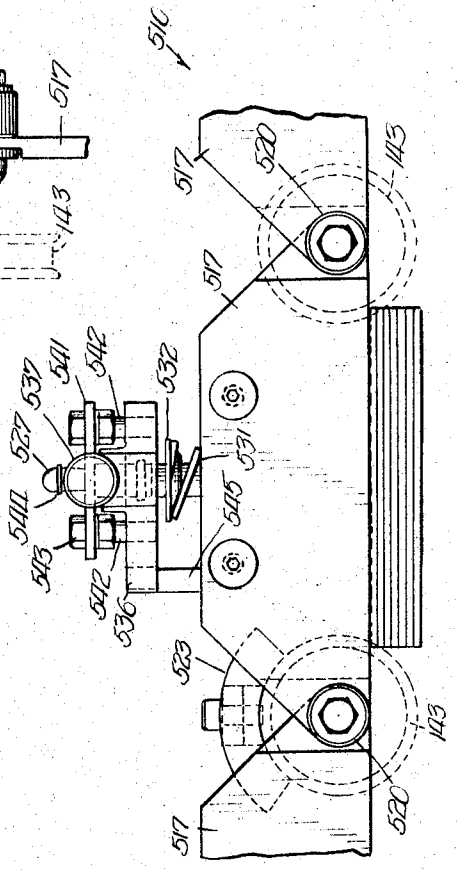

Fig. 44

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3,299,608

PACKAGING MACHINE

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Filed Aug. 29, 1963, Ser. No. 305,324
36 Claims. (Cl. 53—112)

The invention relates to a packaging machine and special components and assemblies for various types of packaging machines, all of which are capable of operating in a continuous manner to form successive packages in continuous packaging film. More specifically, the invention is directed to package forming and handling equipment of an automatic operating nature, which equipment individually and collectively is capable of improved operation in continuous and automatic package forming use.

The packaging machine of the present invention includes an assemblage of individually unique and improved package component handling means, package forming means and package trimming means capable of combined use in a new and improved manner for efficient package forming and handling purposes. While the over-all packaging machine and the individual components and assemblies thereof are especially adapted for the automatic handling of supercooled polyvinylidene chloride film as the basic packaging material, at least certain of the components and assemblies are fully adapted for efficient utilization in other types of packaging machines. Furthermore, it will be understood that the basic packaging machine of the present invention is adapted for use with other types of packaging films while including certain design features which particularly adapt the same for use with supercooled polyvinylidene chloride film.

It is an object of the invention to provide a new and improved automatically and continuously operating packaging machine capable of unique package component handling, package forming and package separation and removal.

Another object is to provide a new and improved packaging film supercooling and handling means for polyvinylidene chloride film or similar film material capable of exhibiting unique formability and sealing properties in the absence of any substantial application of heat.

A further object is to provide new and improved packaging film retention and conveying means capable of automatic and continuous operation in a packaging machine.

Still a further object is to provide new and improved package forming means capable of efficient placement and retention of package components and evacuation and completion of a package assembled therefrom in an automatic and continuous manner.

Another object is to provide new and improved package component delivery and transfer means to automatically and continuously supply selected package components to a suitable package forming means and particularly the new and improved package forming means of the invention.

Still another object is to provide new and improved automatic and continuous package trimming means capable of removing successive packages from a continuous film and providing for controlled separation and delivery thereof from said film in a new and improved manner.

Other objects not specifically set forth will become apparent from the following detailed description of the

invention made in conjunction with the accompanying drawings wherein:

FIG. 1 is a diagrammatic illustration of the basic operational functions of the over-all packaging machine of the invention;

FIG. 2 is a fragmentary side elevation of a special polyvinylidene chloride film supercooling and conveying assembly forming a part of the packaging machine and mechanically integrated into the over-all operation of the machine;

FIG. 3 is a fragmentary end elevation of the assembly of FIG. 2 as viewed generally along line **3—3** therein;

FIG. 4 is a fragmentary plan view of a film oiler roll unit forming a part of the assembly of FIGS. 2 and 3 and viewed generally along line **4—4** in FIG. 3;

FIGS. 5A and 5B in combined relation diagrammatically illustrate certain portions of the packaging machine and the over-all general operational cooperation therebetween;

FIG. 6 is a fragmentary side elevation of special chain-like film conveying means forming a part of the invention;

FIG. 7 is a fragmentary, partly sectioned plan view of the chain-like means of FIG. 6 as viewed generally along line **7—7** therein;

FIG. 8 is a transverse section of the chain-like means as viewed generally along line **8—8** in FIG. 6;

FIG. 9 is a fragmentary side elevation of a film pick-up reel means forming a part of the machine and cooperating with the film conveying chain-like means to combine film therewith;

FIG. 10 is an enlarged transverse section of the film pick-up reel means of FIG. 9 as viewed generally along line **10—10** therein;

FIG. 11 is a diagrammatic and fragmentary side elevation of package forming means forming a part of the machine and in combination with film application means;

FIG. 12 is a fragmentary transverse section of the film application means of FIG. 11 as viewed generally along line **12—12** therein;

FIG. 13 is an enlarged and partly fragmentary side elevation of the package forming means of the invention;

FIG. 14 is a transverse section of the package forming means as viewed generally along line **14—14** of FIG. 13;

FIGS. 15A and 15B are diagrammatic and fragmentary plan views of the packaging machine of the invention;

FIG. 16 is a partly diagrammatic transverse section of a portion of the machine as viewed generally along line **16—16** in FIG. 15A illustrating a product transfer assembly constituting a part of the invention;

FIG. 17 is a fragmentary side elevation of a head sprocket assembly constituting a part of the product transfer portion of the package forming machine;

FIG. 18 is an exploded perspective of plunger means forming a part of the assembly of FIG. 17;

FIG. 19 is a vertical section of the head sprocket assembly of FIG. 17 as viewed generally along line **19—19** therein;

FIG. 20 is a fragmentary section in elevation of plunger operating means of the assembly of FIG. 17 as viewed generally along lines **20—20** therein;

FIG. 21 is a partly sectioned fragmentary elevation of product transfer arm means with a cover portion thereof removed;

FIG. 22 is a fragmentary and partly sectioned side elevation of the transfer arm means of FIG. 21;

FIG. 23 is a fragmentary transverse section of a package forming cavity of the package forming means illus-

trating package component positioning for evacuation thereof;

FIG. 24 is a view similar to FIG. 23 illustrating final positioning of the packaging components following evacuation thereof;

FIG. 25 is a fragmentary and partly diagrammatic side elevation of a package trimming and removal assembly forming a part of the machine;

FIG. 26 is a fragmentary transverse section of the assembly of FIG. 25 as viewed generally along line 26—26 therein;

FIG. 27 is a fragmentary plan view of the assembly of FIG. 25 as viewed generally along line 27—27 therein;

FIG. 28 is a fragmentary perspective of the package trimming and removal assembly of the machine illustrating the elements thereof in operative position;

FIG. 29 is a view similar to FIG. 28 illustrating certain elements thereof in inoperative position for film threading purposes;

FIG. 30 is a fragmentary perspective of the package trimming and removal assembly of the machine illustrating the interior of the package trimming drum thereof and certain operational components thereof;

FIG. 31 is a face elevation of a cam track member forming a part of the assembly as viewed generally along line 31—31 in FIG. 26;

FIG. 32 is a diagrammatic illustration of the operational features of plunger actuating means forming a part of the trimming drum;

FIG. 33 is a view similar to FIG. 32 illustrating further operational aspects of the plunger actuating means;

FIG. 34 is an enlarged plan view of the face of a plunger means of the trimming drum;

FIG. 35 is a fragmentary end elevation of the plunger means as viewed generally along line 35—35 in FIG. 34;

FIG. 36 is an enlarged fragmentary section of a package triming cavity of the trimming drum illustrating the combination therewith of the cooperating trimming roller forming a part of the assembly;

FIG. 37 is a diagrammatic view in elevation illustrating the cooperating drive arrangement between the trimmer drum and roller as generally viewed along line 37—37 in FIG. 36;

FIG. 38 is an enlarged sectional view of means removably positioning the die means of the trimmer drum;

FIG. 39 is a diagrammatic illustration of the unified drive arrangement of the packaging machine in perspective;

FIG. 40 is a diagrammatic illustration in elevation of a modified package conveying assembly adapted for use with the packaging machine of the invention;

FIG. 41 is a partly sectioned end elevation of one of the package engaging means of the assembly of FIG. 40 as viewed generally along line 41—41 therein;

FIG. 42 is a vertical section of a portion of the package engaging means of FIG. 41 as viewed generally along line 42—42 therein;

FIG. 43 is an enlarged plan view of one of the package engaging means; and

FIG. 44 is a fragmentary side elevation of one of the package engaging means.

FIG. 1 is a diagrammatic flow sheet which generally illustrates the basic sequential operations carried out by the packaging machine of the invention. A tank **10** maintains a supercooling water bath having a temperature of about normal room temperature and, in the form illustrated, three films **11**, **12** and **13** are delivered into the tank **10** from an appropriate extruder assembly **14**, the powder material for use in forming the films being maintained in a supply hopper **15** in communication with the extruder assembly **14**. As an example of a suitable film laminate for use in forming the packages, the outermost continuous films **11** and **13** may be formed from polyvinylidene chloride powder and the intermediate film **12** may be formed from polyvinyl chloride. The three films are laminated in the tank **10** by combining rollers **16** and the continuous combined web is passed under a control roller **17** providing for controlled submerging of the films in the water bath, and is ultimately passed out of the tank as controlled by rollers **20**, **21** and **22**.

The ultimate packaging film **23** is basically a supercooled amorphous polyvinylidene chloride laminate with the intermediate polyvinyl chloride film layer **12** being sufficiently formable to stretch with the polyvinylidene chloride layers **11** and **13** and remain sealed thereto for package forming purposes. Of course a single ply film may be used, but the laminate described provides substantial strength and oxygen impermeability to permit the forming of a highly efficient food product package.

The use of amorphous supercooled polyvinylidene chloride film for package forming purposes is known. This film in the amorphous supercooled state is quite formable or stretchable and exhibits adherence properties which are unique, such properties being adequate to establish a hermetic seal even with relatively diverse materials such as polyvinyl chloride material. The form of seal used in the package to be described in conjunction with the mechanical and operational features of the packaging machine and components of the present invention involves a relatively rigid plastic base which may be formed from polyvinyl chloride, on which a stack of meat slices, such as bologna or the like, is placed, the basically supercooled polyvinylidene chloride film laminate being collapsed over the product and sealed to the periphery of the base member through an interface of suitable plasticizer such as diethyl phthalate. These particular packaging components are merely illustrative of suitable materials with which the packaging machine and components thereof may be suitably used. In this respect it is not intended that the invention be limited either to the use of these specific package components or, for that matter, amorphous supercooled polyvinylidene chloride film.

Still referring to FIG. 1, selected stacks of meat slices obtained from a supply **24** are weighed on scales **25** and placed on an endless series of trays **26** supported by an endless chain **27**. Base members **30** are continuously supplied by suitable means and deposited on the tops of the stacks of meat slices in inverted position on the trays **26**, each base member having been initially provided with a peripheral coating of a suitable plasticizer by spray means **31** located adjacent a revolving platen **32** receiving the base members **30** thereon.

Suitable product and base member transfer means including a platen-like support member **33** receives the product and associated base member thereon in upright position, the product and base member having been transferred thereto by the help of plunger means **34** cooperating with each tray **26** and separating the stack of meat slices thereon from the tray. Each platen-like transfer means **33** may suitably be heated by a heater **35** during movement thereof into sealing relation with a package forming cavity means **36** which is aligned with the continuously moving film **23**. The film **23** is continuously delivered to a plurality of package forming cavities **36** and successive sections of the film are drawn into the cavities with the stacked product and base member being then injected into the cavities by the supporting platen-like means **33**. With each cavity being thus sealed, evacuation occurs resulting in a collapsing of the film downwardly into intimate engagement with the product and into sealing engagement with the plasticizer coated periphery of the base member. A film pre-heater **37** may be associated with the film **23** prior to package forming cavity application to controllably raise the temperature of the film for controlled inducement of film crystallization. In this respect the heater **35** may be used for a similar purpose but the package forming cavities **36** need not be heated and are "cool" cavities. Supercooled polyvinylidene chloride film maintains its unique sealing properties until adequate transition to the crystalline state

has occurred. Upon reaching adequate crystallization the inherent sealing properties disappear. In order to promote crystallization and yet maintain adequate self-sealing properties in the film for package forming purposes, selected and controlled heating of the film or film engaging equipment may be resorted to in the packaging machine of the invention. By the use of controlled heating substantial crystallization can be brought about as the package is discharged from the machine thereby avoiding any complexities in subsequent package handling due to the retention of adherent properties in the polyvinylidene chloride film. Thus, in essence, adequate heating can be relied upon to controllably advance crystallization and yet fully and adequately utilize the unique sealing properties of polyvinylidene chloride film in the supercooled condition.

The continuous film **23** having a plurality of aligned packages formed therein is conveyed to a package trimming component of the machine including a plurality of cavity-like die members **40** into which a package is received in inverted position and pressed thereinto by package engaging means **41**. A rotating roller **42** engages each die member **40** and trims the individual package from the continuous film **23** with the scrap being conveyed from the machine on an endless belt **43** through scrap discharge and combining means **44** into a waste container **45**. Each cavity-like die member **40** includes plunger-like ejector means **46** which controllably ejects a trimmed package from its associated die member and deposits the same on a continuously moving supporting surface **47** which carries the successive packages past a package counter **50** of known type and a suitable label application means **51**. In this manner the packaging components are automatically and continuously moved into the packaging machine and combined therein to form packages successively aligned longitudinally of the continuous film **23** and each package is then automatically removed from the continuous film and controllably delivered from the machine through labeling means as a finished package ready for merchandising.

FIGS. 2–4 illustrate the special film supercooling tank assembly of the invention which receives the film plies **11**, **12** and **13** from the extruder assembly **14** as diagrammatically illustrated in FIG. 2. The assembly **10** includes a tank **52** containing water therein with the level of the water being identified by the numeral **53**. The film combining rollers **16** are mutually engaged and at least one of the rollers is driven by a chain **54** extending along one side of the tank **52** within a chain guard **55**, the chain extending over the drive sprocket of the submerged roller **17** and under one of a pair of spool-shaped sprockets **56** and around a drive sprocket **57** of a gear **60**. Chain **54***a* extends upwardly around a drive sprocket of the top projecting roller **20** which is positioned above the tank **52** to receive the film **23** thereon as diagrammatically illustrated in FIG. 1 and then back down to the other spool-shaped sprockets **56**. As shown in FIG. 4, the gear **60** is suitably fixed on a transverse shaft **61** supported at opposite ends by frame members **62** and **63** in turn carried by the tank **52**. The drive sprocket **57** is at the opposite end of the shaft **61** with the drive chain **54** engaged therewith. The transverse shaft **61** carries the film engaging roller **21** referred to in FIG. 1, this roller extending across the front lower end portion of the tank **52** in engagement with a film oiler roller **64**.

Still referring specifically to FIG. 4, the oiler roller **64** includes a central shaft **65** mounting thereabout a series of ring-like felt members **66** capable of absorbing a suitable edible oil for application thereof to a surface of the film **23** received continuously from the supercooling tank **52**. The shaft **65** is suitably rotatably mounted on transversely positioned frame members **67** supported by the tank **52** and a drive gear **70** carried by the shaft **65** engages a gear **71** carried by the shaft **61** of the roller **21**. In this manner the oiler roller **64** rotates against the roller **21** and coats the same with oil which is transferred to the film moving under the roller **21**. This oil is supplied through a transverse distributor pipe **72** suitably mounted on a frame member **73** (FIGS. 2 and 4) and receiving centrally thereof a flexible supply hose **74** connected to an overhead oil supply unit **75** (FIGS. 2 and 3) suitably mounted on the tank **52**. The distributor pipe **72** includes a plurality of apertures **76** along the bottom surface thereof through which oil drips onto the felt rings **66** of the oiler roller. The oil is preferably supplied to the top face of the continuous film **23**, which face is arranged for ultimate engagement with the outer surface of the package forming drum to prevent sticking of the film to the drum surface and to the surfaces of the package forming cavity with which the film comes into intimate contact.

The roller drive arrangement, to the extent previously described including the chain **54**, is arranged for positive movement of the laminated film **23** through the water bath **53** of the tank **52** upwardly over the roller **20** and downwardly under the roller **21**. The reversing of the drive chain **54***a* caused by the arrangement of the spool-shaped idler sprocket **56** permits unitary directional driving rotation of the various rollers with the exception of the oiler roller **64** which is directly engaged with the roller **21** by gears **70** and **71** as previously described. A single drive including the chain **54** includes the gear **60** which as best shown in FIGS. 2 and 3 is engaged with an intermediate gear **77** rotatively mounted on a bar **80** which at its lower end is pin connected to a transverse shaft **81** suitably journalled through parts of a water tank supporting frame **82** engaged with the bottom of the tank **52**. This frame includes a pair of depending front leg portions located adjacent the front end of the tank **52** and rearwardly extending angle members **83** (FIG. 2) which engage the tank near the outermost end portion thereof. Referring again to FIG. 3, the opposite end of the transverse shaft **81** has fixed thereto a bar member **84** identical to the bar member **80** and fixed to and overlying an elongated bar member **85** which at the upper end thereof carries a spring loaded detent **86** including a push-pull control knob **87**. The bars **80**, **84** and **85** form a part of a dog clutch including the shaft **81** and the knob control detent **86** resiliently engages a projecting plate **90** fixed to the tank frame and including a laterally spaced disengaged recess **91** therein for the detent **86**. Thus in order to disengage the roller drive arrangement, the knob **87** is pulled outwardly and the bar **85** is pivoted counterclockwise as viewed in FIG. 2 with the shaft **81** pivoting therewith and the bar **80** moving through a corresponding arc. With this movement the gear **77** is pivoted out of engagement with the gear **60** and the drive of the interconnected rollers is disrupted. This interruption would be resorted to when the packaging machine is closed down at the end of a packaging run or for maintenance or the like.

The movable gear **77** is engaged with a drive gear **92** carried on the shaft **81** by a relatively rotatable sleeve **93** which in turn is driven by a spool gear **94**. A drive chain **95** (FIG. 2) extends from the spool gear **94** to a main drive gear **96** mounted on a main frame portion **97** of the packaging machine. The gear **96** includes a drive shaft **100** carried in a journal member **101** mounted on the main frame **97**. A parallelogram linkage including a pair of transversely spaced upper bars **102** and a pair of transversely spaced lower bars **103** extends between the main frame **97** and the frame **82** of the water tank **52**. Another upper bar **102***a* similar to and acting coincident with the pair of upper bars **102** is associated directly with the gears **94** and **96** and carries thereon a chain tensioning sprocket **104** engaging the chain **95** as shown in FIGS. 2 and 3. The upper bars **102** are pivotally mounted at one end about the shaft **81** of the water tank assembly and at the other ends about the shaft **100** of the main drive carried on the main frame **97**. The

lowermost bars **103** are pivotally mounted at one end thereof on a transverse shaft **105** suitably carried on the frame **82** of the water tank assembly and the other ends of the bars **103** are pivotally mounted about a transverse shaft **106** suitably carried on the main frame **97**. The shafts **81**, **100**, **105** and **106** function as fulcrums for the parallelogram linkage defined by the bars **102** and **103**.

The water tank and frame members **82** and **83** thereof are vertically supported by a double acting air cylinder unit **107** with the cylinder portion **110** thereof pivotally mounted through a pin **111** to a fixed base **112** which would be attached to the floor of a packaging plant or the like. The cylinder portion **110** includes therein the conventional reciprocating piston rod **113** extending upwardly and inclined away from the main frame **97** and connected by a pivot pin **114** to a pivot plate **115** which is fixed to the water tank frame **82**. The air cylinder **107** is operated through flexible hoses **116** attached to air pipes **117** carried on the main frame **97** and suitably connected with a control valve unit **120** having an operating handle **121** and breather pipes **122** of known type. Suitable operation of the control unit **120** results in reciprocation of the piston rod **113** relative to the cylinder portion **110** and an accompanying raising and lowering of the water tank **52** and frame thereof relative to the fixed main frame **97**. During movement of the water tank and its associated frame, its position relative to the main frame **97** is controlled at all times by the parallelogram linkage defined by the bars or arms **102** and **103**. As can best be appreciated from FIG. 2, movement of the water tank **52** upon operation of the air cylinder **107** proceeds along a generally vertical arcuate path the radius of which taken at any point therealong is equal to the distance between the centers of the shafts **81** and **100** and the shafts **105** and **106**. In this manner the drive centers of the drive sprocket **97** and the driven sprocket **94** are maintained in constant relation thereby permitting continuous drive transmission to the movable water tank assembly from the main frame portion **97**. Thus during the arcuate vertical movement of the water tank **52** a continuous drive of the various rollers forming a part thereof can be maintained at all times.

The foregoing continuous drive arrangement for the water tank assembly is of particular significance in connection with the starting up of the packaging machine. The extruder assembly **14** is fixed relative to the water tank **52** and this assembly is started and the issuing film plies must then be suitably threaded through the rollers of the water tank assembly and into the film receiving parts of the packaging machine. For ready access to the various rollers in the water tank **52**, the tank assembly is lowered sufficiently to permit adequate spacing between the same and the extruder assembly **14**. The extent to which the tank assembly is lowered is controlled by the bottoming of the air cylinder **107** with the piston rod **113** thereof retracted into the cylinder portion **110** to its fullest extent. Lowering is brought about by operation of the control unit **120**. Film issuing from the extruder assembly **14** is threaded through the various rollers and the threading is aided by the driving of the rollers through the drive arrangement previously described. This drive arrangement is maintained operative regardless of the degree of elevation of the water tank assembly by reason of the parallelogram linkage including the arms **102** and **103** previously described. Upon completion of film threading through the water tank assembly, as well as the entire packaging machine as the case may be, the air cylinder **107** is operated through the control unit **120** to raise the tank assembly along its arcuate path of movement toward the extruder assembly **14**. During this raising operation the degree of stretch of the film being received by the driven rollers of the water tank assembly can be varied to thus control not only the thickness of the ultimate film laminate but also the width of the same. Depending upon the type of packages being prepared, a selected film thickness and width may be set by the provision of suitable stop means adjusted to control raising of the water tank assembly a prescribed extent. FIG. 2 best illustrates the stop arrangement as including integral vertical arm portions **123** carried by the parallelogram bars **103** and having radial flanges **124** thereon receiving captive adjustment screws **125** therethrough with adjustment nuts **126** determining the extent to which the screws **125** project outwardly from the flanges **124** into engagement with a transverse bar **127** carried on the main frame **97**. Any suitable means of height adjustment can be utilized and this particular arrangement illustrates a simple means whereby the final positioning of the water tank relative to the extruder assembly **14** can be precisely controlled. Adjustment of the screws **125** can vary this final height and thus vary the width or even the thickness of the film. During the upward movement of the water tank assembly the positive roller drive arrangement is maintained in operative relation and advancement of the film through the assembly continues. Roller speed during any movement of the water tank assembly is maintained constant.

The tank assembly **10** is completed by the provision of suitable chain guard housings **130** and **131** extending about the main drive chain **95** and its associated sprockets and gears. The fixed speed of the various rollers can be varied depending upon the speed of the packaging machine with which the assembly **10** is to be used by the ready replacement of the gear **60** which is readily available for removal without interrupting any of the remaining inter-related drive elements. Thus a gear having fewer or greater teeth may be substituted for the gear **60** to vary the speed of film movement through the assembly as desired.

FIG. 5A diagrammatically illustrates the continuous delivery of the film **23** from the water bath **52** past the roller **21** at which point an oil coating is applied to the upper surface of the film, past a guide roller **132** mounted on the main frame **97** and into converging relation with an endless series of transversely spaced and continuously moving film gripping chains **133**. As shown in FIGS. 5A and 5B, the film gripping chains **133** move endlessly about a film pick-up reel **134** rotatably mounted on the main frame **97** (FIG. 5A), about an idler reel **135** rotatably mounted on the main frame **97** (FIG. 5B), into engagement with a rotating package forming drum **136** (FIG. 5B), from the package forming drum **136** along a suitable support means **137** carried by the main frame **97** (FIGS. 5A and 5B), into engagement with a package trimming drum **140** (FIG. 5A), and downwardly through suitably spaced guide means **141** into a return engagement with the film pick-up reel **134** (FIG. 5A). Each of the film gripper chains **133** are sprocket driven by the various rotating members of the packaging machine and each chain generally is formed from a series of pivotally interconnected straight links **142**, one of which is shown in detail in FIGS. 6–8.

Each link **142** at opposite ends thereof is bifurcated and has mounted therein a roller **143** rotatably carried on a transverse linking pin **144** which permits overlapping pivotal engagement between adjacent bifurcated ends of adjacent links. The central portion of each link has journalled transversely therethrough from the outer side thereof a gear shaft **145** carrying a sleeve bearing **146** and a bevel gear **147** at the inner end thereof. The bevel gear **147** engages a pair of opposed and longitudinally spaced bevel gears **150** suitably journalled through projecting link shoulder portions **151**. The shafts of the bevel gears **150** have a pair of jaw members **152** and **153** attached thereto for movement into and out of bottom surface engagement as illustrated in FIG. 8. The attachment of the jaw members to the bevel gear shafts may be accomplished in any suitable manner. As illustrated, one bevel gear shaft has suitably fixed thereto an ear portion **154** of the jaw member **153** and the other bevel gear shaft has fixed thereto an ear portion **155** of the jaw member **152**. The

outer end of the shaft of the first mentioned bevel gear has rotatably aligned thereon an ear member **156** of the jaw member **152** and the outer end of the other shaft has rotatably aligned thereon an ear member **157** of the jaw member **153**. In this manner the longitudinally extending jaw members **152** and **153** are adequately balanced on the respective shafts of the bevel gears **150** and the arrangement of these bevel gears relative to the center bevel gear **147** provides for opposite directional movement of the jaw members toward and away from one another upon rotation of the transverse shaft **145**. The enlarged outer end of the bevel gear shaft has suitably fixed thereto a cam actuated operating arm **160** which as best shown in FIG. 6 is provided at the outer end thereof with an elongated opening **161** in which a cam roller **162** is received and projects outwardly therefrom as best illustrated in FIGS. 7 and 8. The cam roller **162** is rotatably mounted on a pin **163** extending through an end of a locking arm **164** which includes a sleeve portion **165** pivotally received about a transverse pin **166** suitably confined in the body of the link **142**. The confinement of this pin involves a removable closure plate **167** overlapping an enlarged diameter central portion of the pin **166** and attached to the link by fasteners **170**.

Suitable camming means, to be described, constitute a part of the film pick-up reel **134** generally illustrated in FIG. 5A and operates to engage successive cam rollers **162** of successive chain links **142** to pivot the same downwardly into the jaw member locking position illustrated in FIGS. 6 and 7. Downward movement of each cam roller is permissible by the pivoting of the support arm **164** thereof, the cam roller sliding in the elongated slot **161** of the operating arm **160**. Downward movement of the cam roller results in clockwise pivoting of the gear operating shaft **145** as viewed in FIG. 6 and operation of the jaw members **152** and **153** into engaging relation as shown in solid lines in FIG. 8. FIG. 6 illustrates the outermost end portion of the confined slot **161** as including an enlarged area **171** into which the cam roller **162** becomes locked upon movement past a dead center relation. The enlarged area **172** includes opposite rim portions **173** past which the cam roller must be forced and the jaw members **152** and **153** are thus locked in tight opposite surface engagement. The jaw members can be unlocked and moved into virtually vertical relation as illustrated in broken lines in FIG. 8 by reverse movement of the cam roller **162** of each link as brought about by suitable camming means to be described. In the reversed unlocking movement the slot **161** including the locking rim portions are operative to positively lock the jaw members in spaced relation.

It will be borne in mind that the film gripping chains **133** of FIGS. 5A and 5B consist of a series of transversely spaced and parallel acting links **142** which are pivotally interconnected with adjacent links. The arrangement is such that the jaw members of transversely opposed links are in alignment for mutual cooperation in the gripping of opposite edge portions of the film **23**. FIG. 8 illustrates the gripping of an edge portion of the film **23** by one of the chain links **142**, it being borne in mind that the opposite edge portion of this particular section of the film is similarly gripped by a cooperating chain link. As the chain links converge with the film **23** at the film pick-up reel **134** as illustrated in FIG. 5A, the jaw members **152** and **153** of each link are in the open position as illustrated in broken lines in FIG. 8. The virtual vertical positioning of these jaw members readily permits receiving of the film **23** past the same and centrally thereof for subsequent gripping of the margin of the film when the jaw members are closed. Each jaw member includes a peripherally continuous resilient gasket **174** aligned for compressive engagement with the film **23**, the gaskets of cooperating jaw members being mutually aligned. This resilient action permits ready cam operated movement of the cam roller **162** past the rims **173** of the enlarged end area **171** of the elongated slot **161**. Opposite marginal engagement of the film **23** by cooperating laterally spaced links **142** transforms the continuous film **23** into a series of flat film sections for controlled engagement with the package forming drum **136** generally illustrated in FIG. 5B as will be described. These film sections as defined by the length of the cooperating jaw members are of sufficient length to permit the complete forming of a package within the confines thereof.

FIGS. 9 and 10 illustrate the film pick-up reel **134** and its cooperation with the film gripper chains **133** and the converging film **23**. Referring particularly to FIG. 10, the reel **134** is in the form of two half sections mounted on sleeves **175** which are rotatable about a fixed shaft **176**. Each half section, among other things, includes a film gripper chain sprocket-like member **177** which, as best shown in FIG. 9, is provided with a plurality of outwardly projecting and circumferentially spaced groove-like seats **180** in which the rollers **143** of the spaced gripper chains are received. In this respect then the straight links of the gripper chains bridge the distances between the sprocket seats **180** in straight line manner as shown in FIG. 9, the chains converging with the reel **134** along the lower portion thereof between an arcuate bottom guide shoe **181** and the reel. Each reel section includes a projecting transverse vane portion **182** arranged to engage the film **23** transversely of the same in alignment with the pivotal interconnections of adjacent links. Thus the vanes **182** support the film at opposite edges of the flat sections thereof as defined by the chain links to maintain the flat film sections without distortion thereof.

Each reel section as shown in FIG. 10 includes a drive gear **183** suitably fixed to the sprocket **177** and rotatable therewith and engaged with a rotatable intermediate gear **184** mounted on a fixed housing **185** which is suitably keyed to the fixed shaft **176**. The intermediate gear **184** is engaged with a cam gear **186** also carried on the housing **185** and having fixed thereto a rotatable cam disc **187** located in the lowermost portion of the reel. With this arrangement the cam disc **187** in each half section of the reel is driven as a result of rotation of the reel, the cam disc maintaining its lowermost position as the reel rotates. The fixed shaft **176** is suitably supported by end members **190** forming a part of the main frame **97** and the reel half sections are driven in timed relation by a main drive chain **191** extending centrally thereof. The chain **191** engages a sprocket **192** which is rotatable about the shaft **176** by being fixed to a main bearing **193** received about the shaft. The sprocket **192** is drive connected to the respective reel half sections through circumferentially arranged shock absorber units **194** of known type. The main drive provided by the chain **191** is a continuous even drive whereas the drive engagement brought about by the gripper chains engaging the sprockets **177** of the reel half sections is of a pulsating nature. This pulsating action is due to the operation of the trimmer drum **140** as will be described. In order to smooth out the operation of the film pick-up reel **134**, it is preferred that a main smooth drive be applied thereto as brought about by the attachment of the main drive chain **191**. The shock absorbers **194** function to smooth out the operation of the reel by permitting absorption of the pulsating forces applied to the reel by the gripper chains. Furthermore, the shock absorbers **194** permit sufficient independent rotation of the reel half sections to accommodate any slight variance in linkage alignment of the laterally spaced chains.

FIGS. 5A and 9 illustrate the converging of the film **23** and gripper chains **133** tangentially at the lower portion of the pick-up reel **134**. The vanes **182** function to engage the film **123** and transform the same into relatively flat sections between the open jaw members **152**

and 153 of each pair of transversely aligned chain links 142. As previously described, the open position of the jaw members permits ready clearance of the film 23 therebetween and the vanes 182 of the reel provide for positioning of the film to be engaged by the jaw members upon closing of the same. As the chains and film advance accompanied by rotation of the reel 134, the cam rollers 162 of the chain links are engaged by the rotating cams 187 of the reel. FIG. 9 illustrates the downward movement of the locking arm 160 of each chain link as the cam roller 162 is forced downwardly by the rotating cam 187. Ultimately the cam roller is forced downwardly past the dead center locking position to an extent that the jaw members 152 and 153 grip the adjacent marginal portion of the film 23 and the film is transversely gripped as shown in the bottom portion of FIG. 10. The chains issue from the opposite side of the reel 134 with the film 23 gripped therebetween as shown in FIG. 9. The shoes 181 of the reel 134 aid in guiding the chains into proper engagement with the sprockets 180, these shoes being suitably supported from the frame members 185.

The locking arm 160 of each chain link must be moved through a substantial arc such as on the order of 120° into locked position. The force applied to the cam roller 162 must be sufficient to force the same past the rims 173 of the elongated slot 161. The operation of film gripping is preferably completed in a short time as it is desirable to uniformly clamp the film without risking any distortion thereof. In this respect then, the particular form of camming means constituting the driven cam disc 187 is especially suitable to meet all of these requirements. The reel 134 is preferably made in separate half sections to permit relative positioning of the half sections along the shaft 176. This permits adjustable spacing of the vanes 182 to accommodate various widths of film. As shown in the lower portion of FIG. 10, the positioning of the vanes should be such that adequate opposite marginal portions of the film overextend the same to be gripped by the chain links. Preferably, the linear speed of the driven cams 187 is approximately equal to the speed of the chains.

The gripper chains 133 with the film 23 gripped therebetween continue from the film pick-up reel 134 as shown in FIG. 5A to an idler assembly 135 shown in FIG. 5B which is in close cooperative association with the package forming drum 136. The primary function of the idler assembly 135 is that of controllably aligning and applying the gripper chains and flat film sections carried thereby in face engagement with the package forming drum 136. Referring particularly to FIGS. 11 and 12, the idler assembly 135 is of drum-like configuration including a center shaft 195 about which a sleeve 196 is rotatably mounted, this sleeve having fixed to opposite ends thereof sprocket-like chain supports 197 of the type previously described which include circumferentially spaced groove-like seats 200 in which the rollers 143 (not shown) of the chain links 142 are adapted to be received similarly as in the case of the film pick-up reel. The idler drum 135 need not be power driven as the movement of the chains in engagement therewith is adequate to rotate the same. FIG. 5B illustrates the use of a one-piece lever 201 which is pivotally received about the main transverse shaft 202 of the package forming drum 136 and has one end thereof pivoted to the shaft 195 of the idler drum and the opposite end thereof connected to a tension spring 203 suitably fixed to the frame 97. The arm 201 through the spring 203 urges the idler drum 135 into engaging relation with the packaging drum 136 and yet permits ready pivoting of the idler drum away from the packaging drum 136 in the event of any jamming caused by improper seating or mating of the gripper chains either with the idler drum 135 or the package forming drum 136.

As best illustrated in FIG. 12, the idler drum 135 includes a plurality of circumferentially spaced transverse plates 204 suitably fixed to the sprockets 197. Each of the plates 204 has journalled therethrough a pair of transversely spaced reciprocating rods 205 which project at opposite ends from the outer and inner edges of the plates. The inner ends of the rods 205 have lock nuts 206 threaded thereon and the outer ends include coil springs 207 retained between the outer edge of the plate 204 and the inner surface of a transverse vane member 210. In this manner the vane members 210 are mounted for reciprocation and are positioned to become engaged by the periphery of the package forming drum 136 during rotation of the idler drum 135.

FIG. 11 illustrates the engaging of the vane members 210 with the film 23 as the same is delivered by the gripper chains to the idler drum 135. This engagement occurs in the areas of pivotal connection of the links of the gripper chains thus maintaining the flat film sections defined by the gripper chain links. As the gripper chains and film are transferred to the package forming drum 136, the vane members 210 engage spaced areas of the periphery of the package forming drum and press the film thereagainst. The package forming drum 136 is illustrated diagrammatically in FIG. 11 as including a plurality of joined flat peripheral surfaces 211 centrally of which package forming cavities 212 are provided. The flat surfaces 211 are dimensioned to be co-extensive with the flat film sections defined by the gripper chains and in this manner each film section smoothly and snuggly overlies and engages a corresponding flat surface portion 211. The vane members 210 are located to engage the junctures of the adjacent flat surface portions 211 thus clamping the film transversely against the drum 136 and sealing the transverse margins thereof. It is during the momentary clamping of the film against the flat surface portions of the package forming drum that the evacuation system of the drum (to be described) functions to draw the film into the aligned cavity 212. In this manner then, each flat film section is completely peripherally sealed against a flat surface portion of the package forming drum, a side marginal seal being obtained through means carried by the drum.

The basic elements of the package forming drum 136 are illustrated in FIGS. 13 and 14. Referring particularly to FIG. 14, the main shaft 202 is a rotating shaft driven by suitable means to be described and has keyed thereto the drum body portion 213 including a pair of laterally spaced sprocket-like chain supports 214. FIG. 13 illustrates each sprocket portion of the chain supports 214 as including the chain roller receiving groove-like seats 215 adapted for gripper chain engagement in the manner previously described. In this respect the package forming drum 136 may be driven by the gripper chains 133 or may be separately driven in timed relation therewith. The lower portion of FIG. 14 illustrates the combining of the gripper chains 133 with the drum 136 and sprockets 214, each package forming cavity 212 including a side marginal gasket 216 extending peripherally along the drum to engage side margins of the film sections in each flat surface portion 211 to seal the film against such surface portion. The lower portion of FIG. 14 also illustrates the film 23 as having been drawn into the cavity 212, this being accomplished by a valving arrangement permitting evacuation of the cavities of the drum 136.

Fixed relative to the shaft 202 in suitably supported relation on the main frame 97 is a vacuum manifold member 217. This member includes a vacuum storage chamber 220 which may be circumferentially continuous if desired and which has a fitting 221 to which a suitable vacuum pipe (not shown) may be attached. A vacuum pump draws the air continuously from the chamber 220 and the manifold member 217 includes a plurality of ports 222, 223 and 224 extending therethrough and exposed to slots 225, 226 and 227 respectively along the inner sur-

face of the manifold member **217**. Preferably a two stage system of evacuation may be employed by having two individual vacuum pumps attached to the machine to two isolated chambers **220** each having ports typically designated as **222**, **223** and **224**. The second stage pump may be capable of drawing a higher potential vacuum for finishing the evacuation of each individual package. The duration of evacuation is designed to act on each package one at a time to prevent a leak in one cavity from affecting adjacent packages. The drum structure **213** includes a side plate **230** rotatable therewith and carrying a plurality of ports **231**, **232** and **233** therein which extend into the drum structure into association with each package forming cavity **212**. The outer face of the plate **230** and the inner face of the manifold member **217** are engaged with one another as a rotating seal and the various series of circumferentially spaced ports **231**, **232** and **233** become aligned with the various slots **225**, **226** and **227**, which are designed with proper length and location to achieve a specific desirable timed evacuation and vacuum release in the package forming cavities **212**. A suitable vent arrangement includes a port **234** in the manifold member **217** exposed to the atmosphere and in communication with a slot **235** along the inner sealing face portion of the manifold member which successively comes into communication with one or more of the ports of the package forming drum.

The vacuum port **231** communicates with an annular chamber **236** to permit the drawing of vacuum in a cavity **212**. The cavity includes an insert ring **237** the inner surface of which is not sealed thus permitting air to be withdrawn from the cavity past the ring. The port **233** communicates with the interior of each cavity behind the piston **241** thus allowing a balance of pressure to the space behind the piston to avoid a pressure difference which would cause the piston to move. The port **232** extends internally radially outwardly within the side plate **230** and receives in the outer end thereof a resilient cup member **240** designed for engagement with a product transfer arm of a type to be described.

Each package forming cavity **212** includes a movable plunger-like bottom surface member or piston **241** therein which is fixed to a shaft-like rack **242** engaged with a rotatable pinion **243** carried on a shaft **244** (FIG. 14) which projects outwardly of the drum structure **213** and has fixed thereto a crank arm **245** carrying a cam roller **246** thereon. Each cam roller **246** is received in a cam track **247** suitably fixed relative to the shaft **202** and supported in any appropriate manner as by the main frame **97**. The piston **241** of each cavity also has engaged therewith a spring **250** which urges extension of the bottom member **241** within the cavity to the shallow cavity position. Cam roller **246** and cam **247** oppose this spring pressure in one direction and are aided by it in the other direction.

The ports **231** and **233** become aligned with the vacuum slots **225** and **227** respectively when the film **23** and the gripper chains are combined with the package forming drum as shown in FIG. 11. At this stage of the operation the flat film sections are fully sealed against their respective flat surface portions **211** of the package forming drum by reason of the side gaskets **216** of each cavity and the transverse vane members **210** of the idler drum **135**. The vacuum created within the appropriate cavity **212** is sufficient to draw the central portion of the flat film section applied thereover into the cavity and this vacuum is maintained as the cavity moves past the idler drum **135**. The vacuum is maintained by reason of the film having been stretched into the cavity, this film being in tight engagement with the outer flat surface portion of each cavity. The oil applied to the surface of the film prevents subsequent sticking of the film to the package forming drum but does not interfere with the establishing and maintaining of an adequate vacuum seal.

The stacked product to be inserted in each cavity as generally described above is then suitably injected into each appropriate cavity and preferably the height of each stack is sufficient to urge the cavity bottom member **241** inwardly against the spring **250** associated therewith. This particular arrangement also permits the accommodation of product of varying height. The product is then tightly engaged with the film in the cavity and the final package evacuation operation is brought about in a manner to be described. The cam track **247** of the package forming drum functions to subsequently aid in the ejection of a finished package from each cavity. Any suitable cam track configuration may be used and that illustrated in FIG. 13 is merely an example of a suitable type. As illustrated in FIG. 13, rotation of the drum **136** is clockwise and the cavity **212** illustrated in solid lines has received therein the film **23** (the film not being shown in this view), and is about to have a product inserted therein for package formation. As this particular cavity moves clockwise upwardly along the left-hand portion of the path of rotation of the drum as viewed in FIG. 13, the pinion **243** operates to positively retract the plunger-like bottom member **241** in the cavity to enlarge the same to adequately permit the receiving of a product therein. Sufficient travel is provided in the spring **250** to permit even further retraction of the plunger to readily accommodate any variation in product height. Toward the top of the path of circular movement the cam roller **246** is free to move downwardly along a substantially abrupt portion of the cam track **247** thus freeing the plunger member **241** to move outwardly within the cavity and aid in the ejection of the finished package therefrom. The spring **250** is effective in aiding this type of action. In the event that the pinon **243** does not return the rack member **242** outwardly, a positive cam track portion **251** is provided to engage the cam roller **246** and return the same into proper engagement with the track **247**. In this manner the plunger member **241** is returned to its initial position to again receive a film section in the cavity and ultimately be retracted for product insertion.

FIG. 5B illustrates the product supply and transfer assemblies as including the endless chain **27** carrying a plurality of trays **26** on which selected stacks of product **24** are supported with a package base member **30** applied to each stack. In general, the product stacks are delivered to a product transfer assembly **252** including a plurality of transversely oscillating transfer arms **253** including as a part thereof the product supporting platens **33** which also function with the package forming drum **136** to close off the cavities thereof. FIGS. 15A and 15B illustrate the general arrangement of these elements of the machine in plan view, the product conveyor **27** extending endlessly over a head sprocket assembly **254** with the product transfer assembly **252** being located between the product conveyor and head sprocket assembly **254** and the package forming drum **136** in paralleling relation.

Considering FIGS. 15A, 15B and 16, the product transfer assembly **252** comprisng the plurality of laterally oscillating transfer arms **253** maintains these arms in generally vertical position as the same are being moved from the top portion of the package forming drum **136** to the head sprocket assembly **254**. Upon reaching the head sprocket assembly **254**, each transfer arm **253** is pivoted downwardly to the right as viewed in FIG. 16 to bring the product supporting platen **33** thereof in overlying engagement with the inverted product including the base member **30**. The horizontally positioned transfer arm **253** then moves downwardly over the end of the head sprocket assembly in timed relation therewith as best illustrated in FIG. 15B and upon reaching the bottom portion of the return travel of the conveyor **27**, the particular transfer arm **253** is inverted as is the product and base member as shown in the bottom portion of FIG.

16. The transfer arm then actually supports the product and base member on the platen 33 thereof and at this point of the operation is pivoted approximately 180° as shown in the series of broken line positons in FIG. 16. This transverse movement of each transfer arm 253 results in a translation of the product and base member still supported on the platen 33 into vertical alignment with the bottom portion of the package forming drum 136. The transfer arm 253 moves back into an approximately horizontal position resulting in the product and base member being injected into a package forming cavity 212 of the package forming drum 136 and the platen 33 sealing off the cavity for package evacuation purposes. The transfer arm 253 then moves upwardly with the package forming drum 136 as illustrated in FIGS. 5B and 15A and following package evacuation and formation each transfer arm is removed from cavity closing relation and returned into the vertical positon previously described. This movement is illustrated in FIGS. 5B and 15A. The transfer arms in the various views referred to are schematically illustrated as these views are merely intended to show operation of the arms and related components.

FIGS. 17–20 illustrate the main features of the head sprocket assembly 254. Referring particularly to FIG. 19, this assembly includes a drum-like structure 255 which is keyed to a rotatable shaft 256 suitably driven from the main drive arrangement to be described. The drum 255 includes a sprocket 257 engaged with the conveyor chain 27 carrying the series of product supporting trays 26. The drum 255 includes a plurality of circumferentially spaced recesses 260 including thereon reciprocal plunger-type pistons each having a piston head portion 261 and a piston rod portion 262 suitably journalled in a member 263 received in the cavity and fixed therein by a retainer plate 264. A spring 265 engages the piston head 261 and the retainer plate 264 to aid in maintaining proper positioning of the piston for operative use.

FIG. 18 illustrates the details of construction of each of the pistons. The piston head 261 has suitably attached thereto by a fastener 266 or the like a wing shaped leaf spring 267 designed to resiliently engage the product 24 on the tray 26 and lift the same from the tray. The leaf spring is sufficiently resilient to prevent product adherence to the piston head. To permit product engagement, the tray 26 is formed with a central aperture 270 through which the piston head 261 can be received. The piston head 261 includes a bayonet-type connection with the piston rod 262 involving a slotted sleeve 271 and a pin 272 carried on the rod 262. The rod 262 includes a rack portion 273 engaged with a pinion 274 having an operating shaft 275. FIG. 20 illustrates the shaft 275 as extending outwardly from the rack portion 273 and carrying a gear 276 thereon. The shaft is suitably journalled in a side closure plate 277 forming a part of the drum 255. The gear 276 is engaged with a cam operated gear 280 suitably retained by the closure plate 277 and carried on a radially outwardly projecting shaft 281 which has fixed to the outer end thereof a crank arm 282 (FIG. 19) which in turn has a cam roller 283 attached thereto. The cam roller 283 is received in a cam track 284 forming a part of a fixed member 285 which is held against rotation with the shaft 256 in any suitable manner.

The head sprocket assembly 254 further includes a plurality of circumferentially spaced and radially outwardly projecting supports 286 each having formed in the outer end thereof an outwardly opening groove-like seat 287 in which a supporting finger portion 290 of a transfer arm 253 is received to synchronize and align each arm with each recess 260 of the head sprocket assembly and each product supporting tray 26 associated therewith. In this manner the simultaneously operating head sprocket and product transfer assemblies cooperate between related parts thereof to maintain the continually reoccurring sequences of operation.

As previously described, the series of transfer arms 253 are pivoted laterally into a horizontal position in successive overlying relation with the trays 26 received about the head sprocket assembly 254. Immediately after a tray 26 comes into association with the assembly 254, the cam track 284 (FIG. 19) permits free extension of an aligned piston head 261 due to the pressure of the spring 265. Each piston head 261 emerges through a tray aperture 270 to raise the product and base member into engagement with a platen 33 (FIG. 16). During the downward movement of the associated transfer arms and trays with the head sprocket assembly, the pistons in each recess of the head sprocket assembly are maintained in the extended position by spring pressure which is effective to controllably lift products of different thickness and/or weight. The product is firmly held between the piston and platen until continued downward movement of the associated parts results in a complete transfer of the weight of the product onto the platen, the platen at this point of the operation being arranged in an upright horizontal position as particularly shown in FIG. 16. The product is then completely free from the head sprocket assembly 254 and each product is successively laterally transferred into association with the package forming drum 136. Positive alignment of each transfer arm 253 with an associated product, tray and plunger of the head sprocket assembly is maintained at all times during product transfer in this stage of the machine by reason of the positive engagement between the arm portion 290 of the transfer arm and the grooved seat 287 of the associated support 286. The piston heads 261 are retracted by positive action of the cam track 284.

The product transfer assembly 252 consists basically of longitudinally spaced pairs of sprockets two of which sprockets 291 and 292 at one end of the assembly are shown in FIGS. 16 and 21 and the other of which sprockets 293 and 294 are generally illustrated in FIG. 15B. Both pairs of sprockets may be driven if desired such as by connection of the sprockets 291 and 292 to the shaft 202 shown in FIG. 15A or by connection of the sprockets 293 and 294 to the shaft 256 shown in FIG. 15B. A continuous chain 295 engages the aligned sprockets along each side of the assembly and the links of the chains are attached to the transfer arms 253 to move the arms in continuously aligned relation. The chains and sprockets are suitably encased in fixed guard housings 296. Each transfer arm includes a main body portion 297 which as best shown in FIGS. 16 and 21 includes a pair of laterally spaced depending portions 300 and 301. Each depending portion is located inwardly of a guard housing 296 and has attached thereto a chain link of one of the chains 295. The depending portion 300 is in the form of an ear and includes a cam roller 302 projecting therefrom and engaged in a cam track 303 formed in a fixed center plate 304 extending longitudinally of the assembly. The track 303 is configurated to guide the series of cam rollers 302 of the respective transfer arms 253 to merely maintain stability of the main body portions 297 thereof. The other depending portion 301 of each arm includes a cam roller 305 projecting inwardly therefrom and received in a cam track 306 formed in the opposite surface of the center plate 304, this cam track being configurated to bring about operation of the transfer arm as will be described.

FIGS. 21 and 22 illustrate the details of construction of each product transfer arm 253. The main body portion 297 includes therein a vertically reciprocating slide member 307 which as best shown in FIG. 22 extends downwardly into the depending portion 301 in a slotted area 310 thereof. The bottom of the slide member 307 carries the cam roller 305 and the cam track 306 operates to move the slide member 307 vertically along a reciprocat-

ing path. The outer face of the slide member **307** includes a rack **311** forming a part thereof and operating upwardly into the main body portion **297**. Within the body portion the rack engages a pinion **312** which is fixed by a key **313** to a sleeve **314** journalled in the body portion **297** by a bearing **315**. The sleeve **314** is suitably fixed to a vertically extending arm housing **316** which includes a removable face plate **317**. The housing **316** in the lower portion thereof has mounted therein a pulley **320** supported on a shaft **321** suitably fixed to the main body portion **297** so that the sleeve **314** will rotate about the same upon operation of the rack **311**. A bearing **322** mounts the sleeve **314** relative to the fixed shaft **321** to readily permit rotation of the sleeve about the shaft.

With the foregoing arrangement reciprocation of the slide **307** with the rack **311** forming a part thereof as controlled by the cam track **306** will result in an oscillation of the arm housing **316** through a controlled arc of approximately 180°. The top portion of the main body portion **297** includes a grease cap **323** receiving the top end of the rack therein and preventing loss of lubricant from the assembly. During oscillating movement of the arm housing **316** the pulley **320** remains fixed and this pulley includes a cable **324** reversed about a centrally located idler **325** and extending upwardly therefrom into engagement with a top pulley **326**. The top pulley is mounted on a shaft **327** which extends through a boss **330** formed integral with the top portion of the arm housing **316** and projects outwardly therefrom into fixed engagement with a supporting arm **331** of the platen **33**.

With the foregoing arrangement oscillating movement of the arm housing **316** as previously described will result in movement of this housing relative to the pulley **320** which in turn will result in controlled rotation of the pulley **326** and rotation of the shaft **327** to control the positioning of the platen **33**. The position of the platen is controlled so that its center axis is maintained in a vertical plane at all times. Thus referring to FIGS. 15B and 16 it will be noted that with movement of the transfer arm **253** to the right as viewed in FIG. 16 into overlying relation with the head sprocket assembly **254**, the associated platen **33** remains in its original vertical position. This places the exposed supporting surface of the platen in direct engagement with the base member **30** of the product supported on the associated tray **26**. Concurrent downward arcuate movement of the laid-over transfer arm with the head sprocket assembly **254** retains the relative positioning of the various components as shown in FIG. 15B. Upon reaching the bottom portion of the arcuate path of movement as shown in the lower half of FIG. 16 the platen **33** has become inverted and is actually supporting the product thereon. At this stage of the operation the cam track **306** operates to move the slide **307** and rack **311** to pivot the arm housing **316** through an arc of approximately 180°, during which pivoting the pulley and cable arrangement functions to maintain the platen in a vertical position. The first portion of this transfer operation results in a lowering of the supported product out of association with the head sprocket assembly and tray **26**. The last portion of this transfer operation results in a raising of the product on the platen into association with the package forming drum **136**, this vertical lifting being so timed that the product is actualy inserted into an aligned cavity **212**. It wil be borne in mind that during this lateral translating movement of each of the transfer arms **253** longitudinal movement of the arm continues, the paths of longitudinal operation of the head sprocket assembly **254**, transfer arm assembly **252** and package forming drum **136** being parallel. The insertion of a product from beneath the package forming drum **136** provides for complete control of the product and the position thereof at all times without the necessity of fully confining the same on the platen **33**. The vertical movement of the product is illustrated in FIG. 5B during its introduction into a cavity of the package forming drum **136**. Still referring to FIG. 5B, it will be borne in mind that immediately prior to product insertion into a cavity of the drum **136** the gripper chains have come into engagement with the drum, the flat film sections supported thereby having been applied against the flat surface portions of the drum and the rotating evacuating valve arrangement having been operated to draw the film of each section into its associated cavity. Thus the cavity is fully prepared for the receipt of a product and a transfer arm delivers the product thereinto accompanied by a further partial stretching of the film as described for purposes of complete engagement of the film with the product.

Referring again to FIG. 21, the platen **33** has fixed thereto adjacent a margin thereof an upwardly projecting arm portion **332** having projecting outwardly therefrom the alignment and support arm **290** which engages the projecting supports **286** of the head sprocket assembly **254** previously described. At the upper end of the arm **332** an outwardly projecting evacuation arm **333** extends with an outer end bottom surface portion being provided with a fitting **334** for engagement with the resilient nozzle member **240** of the package forming drum **136**. The arm portion **333** includes a series of ports **335** and **336** which are in communication with a port **337** extending through the arm portion **332** into communication with a circumferential chamber **340** formed in the platen **33** and in communication with a series of ports **341** extending onto the outer face of the platen.

The outer end portion of the vacuum arm **333** of each transfer arm **253** includes a rounded guide portion **342** adapted to be received in groove-like seats **343** formed in outwardly projecting support arms **344** carried by the rotating side member **230** of the package forming drum **136**. Seating engagement between these elements is illustrated in FIGS. 13 and 14. This occurs when the transfer arm **253** is moved into product delivery engagement with a flat surface portion **211** of the package forming drum **136**. With the seating of these elements the vacuum fitting **334** of the arm portion **333** of the transfer arm becomes automatically aligned and sealed with the associated vacum cup **240** of the package forming drum. In this manner the vacuum port **232** of a cavity of the drum is placed in communication with the ports **335**, **336** and **337** of the transfer arm which in turn are in communication with the annular chamber **340** and surface ports **341** of the platen **33**. The platen moves into sealing engagement over the aligned cavity and the product and base member carried by the platen are inserted into the cavity.

FIG. 23 illustrates a typical closed cavity into which the film **23** has previously been drawn by evacuation behind the film through the port **231** and annular chamber **236**. The product **24** and base member **30** carried on the platen **33** has been inserted in the cavity **212** while the port **231** is still under evacuation. With this arrangement the film **23** is maintained in engagement with the cavity insert ring **237** and is spaced from the outer margin of the base member **30** to permit access into the package between the film, product and base member for package evacuation and forming purposes.

Each platen **33** is of two-piece construction including a centrally located base member support **345** suitably secured to a base **346** such as by fasteners **347** or the like (FIG. 22). A gasket **350** is compressed between the parts **345** and **346** and includes appropriate apertures **351** for communication between the chamber **340** and ports **341**. The outer ends of the ports **341** are preferably provided with outwardly extending slotted portions **352** whereby the interior of the package can be evacuated without interference from the bottom flange portion of the base member **30**.

A suitable valving arrangement in the package forming drum can provide for inert gas flushing of the interior of the package immediately prior to final package evacuation if desired. Final package evacuation is brought about by alignment of the port **232** of the drum **136** with the

slot 226 and port 223 of the valving arrangement as shown in FIG. 14. With this alignment a vacuum is impressed through the transfer arm ports 335, 336 and 337 (FIG. 21), as well as the chamber 340 and ports 341 resulting in evacuation of the area between the film 23, product 24 and marginal portion of the base member 30 to evacuate the air from the product. Simultaneously a vacuum is impressed through ports 231 to chamber 236 by suitable valving at slot 225 and port 222 (FIG. 14). Also a vacuum is impressed through port 233 by suitable valving at slot 227 and port 224 (FIG. 14) to effect a balanced condition across plunger member 241 to prevent movement that may be caused by this pressure difference. After complete evacuation of the space between film 23 and product 24 and base 30, port 231, annular chamber 236 are vented to atmospheric pressure to force the film tightly into sealed engagement with the product and base-member as shown in FIG. 24. The vacuum in the drum cavity applied through the ports 233 is also released and vented at atmospheric pressure at this stage. The final package is completely formed with the film being sealed to the base member through the interface of plasticizer as previously described. The package forming operation occurs automatically during continued rotation of the package forming drum 136 accompanied by concurrent rotation of the successive transfer arms 253 therewith. Each successive package formed is held captive within the margins of the film 23, which margins are still gripped by the jaw members 152 and 153 of the chain links 142. It will be understood that the various vacuum ports and vents shown in FIG. 14 are not illustrated in their proper staggered relation. Any suitable arrangement of known type can be used.

Following the package forming operation the associated transfer arm 253 leaves the package forming drum 136 and moves into its initial vertical position as shown at the top portion of FIG. 16. The arm then repeats the cycle as previously described including pivoting into cooperating association with the head sprocket assembly 254 to pick up another product for transfer to the package forming drum. FIGS. 5B and 15A illustrate generally the separation of the successive packages from the top portion of the package forming drum 136, the continuous film surrounding these packages still being engaged by the gripper chains, such engagement being sufficient to readily displace the packages from the cavities of the drum. The gripper chain assembly including the film and packages moves over suitable chain support means 137 into association with the package trimmer assembly 140 shown in FIGS. 5A and 15B. During the package forming operation the film 23 is still in its amorphous supercooled condition insofar as the polyvinylidene chloride plies thereof are concerned. Suitable heaters (not shown) may be associated with the chain support structure 137 to promote adequate crystallization of the polyvinylidene chloride film following package formation to thereby eliminate the adherent properties of such film.

Referring to FIG. 5A, the gripper chains convey the finished depending packages and film to a plurality of annular die members 40 forming a part of the trimmer drum and rotating at a speed to successively receive packages therein. A trim roller 42 suitably engages the die members 40 and separate each package from its surrounding film, the separated package being retained in the die member cavity. Each die member cavity includes a reciprocating package ejector 46 which automatically operates to engage and project a package outwardly from the associated die member during continuous rotation of the trimmer drum 140. The finished package is automatically deposited by the ejector means on the continuously moving labeler conveyor 47 which then moves the successive packages to a labeler 51 of any suitable type. The film from which the packages are separated is still continuous at least marginally thereof and the trimmer drum 140 includes means operative to open the jaw members of the gripper chain links to release the scrap film. This scrap film is delivered continuously onto a scrap conveyor 43 which conveys this scrap to a waste container 45 as shown in FIG. 1. The gripper chains 133 with the jaw members thereof locked in open condition continuously move from the trimmer drum 140 through the guide means 141 back into association with the film pick-up reel 134 whereat a fresh supply of continuous film 23 is engaged by the jaw members and the packaging operation is repeated.

Referring particularly to FIGS. 25–27, the package trimming assembly comprises an octagonal drum 353 mounted for rotation about a pair of cam shafts 354 (FIG. 26) and supported by bearings 355 in side frames 356. The drum 353 includes a sleeve 357 journalled by bearings 355 for rotation relative to the cam shafts 354, these shafts also being rotatable relative to the drum. Still referring particularly to FIG. 26, a main drive input shaft 360 including a chain driven sprocket 361 is carried by one of the frame members 356 and includes an input gear 362 engaged with a driven gear 363 fixed to a transverse cam shaft 364 suitably journalled in the frames 356. The shaft 364 carries within each frame a rotatable cam plate 365 each having a cam track 366 therein. An output gear 367 is fixed to the cam shaft 364 and drives a gear 370 which is fixed to the sleeve 357 of the drum 353. In this manner the input shaft drives the cam shaft 364 which in turn drives the drum 353 and the rotation of the cam plates 365 controls the drive of the cam shafts 354. Crank arms 371 carrying cam rollers 372 are fixed to the cam shafts 354 with the cam rollers being operated in the cam tracks 366 of the respective cam plates 365. The crank arms 371 and associated cam rollers 372 are out of phase relative to one another for a purpose to be described.

Still referring more specifically to FIG. 26, the drum 353 is of generally hollow construction having a closure plate member 373 immediately inwardly of the circumferentially spaced circular die members 40. The package ejector means 46 of each die member cavity includes an operating rod 374 which reciprocates through an appropriate opening in the adjacent portion of the closure plate 373 and is suitably sealed thereto for such reciprocation. One of the cam shafts 354 includes an internal evacuation passage 375 therethrough which is continually in communication with an evacuation pipe 376 carried by a suitable fitting 377 within which the shaft 354 rotates. The pipe 376 in turn is in communication with a fitting 380 carried on one of the frames 356 and to which a suitable evacuating source may be attached. With this arrangement the interior of the drum 353 is constantly under evacuation and the vacuum established therein communicates through the ejector rods 374 and through the ejector heads 46 to controllably retain a package thereon during controlled delivery of the package onto the labeler conveyor 47 in a manner to be described.

The top portion of FIG. 26 illustrates the gripper chains 133 engaged with sprocket-like members 381 of a type similar to the sprocket-like members 177 of the film pick-up reel 134, 197 of the idler drum 135 and 286 of the package forming drum 254. Such sprocket members engage the rollers 143 of the gripper chains for alignment of the chain links with the appropriate die cavities. This particular alignment results in a package being deposited in each die member cavity while the opposite marginal portions of the attached film is still gripped by the jaw members of the gripper chains. With this arrangement the portion of the film immediately surrounding the package supported thereby is placed in engagement with the circular cutting edge of the die member 40 to permit separation of the package from the film, such separation even extending to a trimming of the peripheral portion of the base member 30 if desired. The automatic consecutive depositing of packages in the die members 40 is diagrammatically illustrated in FIG. 5A. A suitable package de-

pressor means 41 diagrammatically illustrated in FIGS. 1 and 25 may be used if desired to assure proper seating of each package in a die member. Referring particularly to FIG. 25, the package depressor 21 may be suitably mounted on a frame member portion 382 appropriately attached to one of the side frames 356.

With the receiving of a package in a die member 40 accompanied by continuing rotation of the trimmer drum 353 and coordinated movement of the gripper chains 133 therewith, each die member 40 passes into operative association with the trimming roller 42 as best illustrated in FIGS. 25 and 27. The trimming roller 42 is a hard metal member having end portions 383 of reduced diameter to permit ready clearance of the gripper chains between the roller and trimming drum 353. The roller 42 is rotatably mounted about a shaft 384 which in turn is supported at its opposite ends by a pair of carriage arms 385. Each of these arms include an upwardly projecting ear-like portion 386 having an inwardly projecting boss 387 from which the scrap conveyor 43 is pivotally hung. This scrap conveyor includes a cradle-like frame 390 having a pair of vertically projecting attachment flange portions 391 which are suitably pivotally attached to the bosses 387. The outermost portion of the frame 390 includes a pair of upstanding side flanges 392 in which a belt roller 393 and a scrap conveying roller 394 are suitably journalled. The rollers 393 and 394 include engaged drive gears 395 and 396 respectively with the roller 394 being driven in a counterclockwise direction in engagement with the conveying belt 43 to deliver scrap therefrom. The innermost end of the conveyor 43 includes a driven roller 397 mounted in the frame 390 annd including an outwardly projecting shaft portion carrying a gear 400 which is engaged with a drive sprocket 401 forming a part of the trimming roller 402. The drive sprocket 401 is suitably engaged with drive chain means 402 (FIG. 26) carried on an outer margin of the trimmer drum 353. This particular drive arrangement will be described in detail.

The roller carriage arms 385 further include depending ear-like portions 403 which are pivotally mounted on a fulcrum shaft 404. The outermost ends of the carriage arms 385 have attached thereto depending plates 405 which mount therebetween a counterweight shaft 406 on which a suitable counterweight 407 is received. As particularly shown in FIG. 25, the counterweight shaft 406 is adjustably movable in longitudinal slots 410 formed in the plates 405 to controllably adjust its position.

The trimmer roller mounting assembly is completed by the provision of a pair of somewhat arcuate weight arms 411 which at their innermost ends are pivotally attached to a transverse shaft 412 suitably mounted to and extending between the side frames 356. Centrally of the arms there is formed on each arm a downwardly opening groove-like collar portion 413 designed for resting engagement on the shaft 384 of the trim roller 42. Between the collor 413 and the outer end of each arm the fulcrum shaft 404 is suitably journalled through each arm thus providing a connection for the pair of weight arms with the carriage arms 385. The outermost ends of the arms 411 are interconnected by a transverse rod 414 located below the scrap conveyor 43.

The arrangement described provides for weight application to the trim roller 42 by reason of the weight of the counterweight 47 being transmitted through the carriage arms 385 to the weight arms 411 because of the fulcrum connection defined by the shaft 404. However, the counterweight 407 is so located that a weight balancing effect occurs as the counterweight is still effective on the carriage arms 385 to urge the same to pivot about the fulcrum shaft 404 with a tendency for the trim roller 42 to move upwardly in opposition to the weight arms 411. A delicate loading of the trim roller 42 is obtained, this feature constituting an important aspect of the invention as the function of the roller 42 is solely that of slicing a thin film against a die member 40, this function not requiring excessive force. Furthermore, proper counterbalancing of the weight applied to the die member 40 is important in order to permit extended use of the die member without resharpening thereof.

By reason of the multiple flat surface shape of the trimmer drum 353, the trimming action afforded by the assembly 140 is a pulsating action. The roller 42 must pulsate vertically to move over the apex of adjacent flat surface portions. Thus the delicate counterbalancing arrangement defined by the various cooperating roller loading arms does not at any one time assert such a substantial pressure against the roller 42 that the roller is prevented from generally vertical pulsating movement. With this in mind the carriage arms 385, the scrap conveyor 43 including its frame 390, and the weight arms 411 all cooperatively pulsate with the trimming roller 42. This arrangement permits continuous engagement of the conveyor 43 in the area of its drive roller 397 with the trim roller 42 for the purpose of delivering the scrap film from the trimming drum 353.

The foregoing arrangement also advantageously adapts itself to effective response to a "no package" condition. In the event that no package is formed in a given flat section of film as delivered by the gripper chains to the trimming drum 353, it is desirable to avoid a cutting out of a blank disc of film as such a disc can be retained by the die member or interfere with efficient operation of the ejector means 46 reciprocating therethrough. In order to avoid film trimming under a "no package" condition, a suitable electric eye unit 415 is carried by the assembly 140 and aligned in the path of the film and gripper chains as the same move into engagement with the drum 353. When a flat section of the film does not contain a package, the electric eye unit 415 functions appropriately to operate a solenoid actuated device 416 (FIG. 25) which is suitably attached to a shaft 417 having a crank arm 420 fixed thereto and extending upwardly therefrom between the side frames 356. The top of the crank arm 420 includes an upwardly opening arcuate rod support 421 adapted to readily accommodate the transverse rod 414 at the outer ends of the weight arms 411. The rod support 421 is closely associated to the rod 414 and under "no package" condition, slight rotation of the shaft 417 moves the crank arm 420 and rod support 421 under the transverse rod 414. This occurs when the trim roller 42 and its associated arms 385 and 411 are in a raised condition by reason of having moved over an apex portion of the surface of the drum 353. During such movement the entire roller assembly including the arms thereof is raised and the extent to which the rod is moved upwardly is sufficient to permit receipt of the rod support 421 thereunder. The crank arm 420 is dimensioned adequately to support the rod 414 in its raised position when the rod support 421 is under the rod 414 and engages the same. This condition lifts the weight arms slightly from the trim roller 42 to substantially relieve the force applied thereto. This lifting also results in a slight lifting of the counterweight 407 and the carriage arms 385 relative to the roller 42 in a counterclockwise direction as viewed in FIG. 25. The force applied to the roller 42 and applied by the roller against the next successive die member 40 is thus substantially relieved without any accompanying substantial translation or movement of the roller 42. The octagonal drum 353 causes the roller 42 and arms 385 to oscillate about the shaft 404 during the "no package" condition as distinguished from normal oscillation about shaft 412 during package trimming. The relieving of the trimming pressure precludes trimming action under a "no package" condition and that portion of the film in which no package has been formed is removed by the scrap conveyor 43 intact. When the electric eye 415 signals the presence of a package in proper position along the film 23, the solenoid activated unit 416 is deactivated and

the crank arm 420 with the rod support 421 moves back into its inoperative position shown in FIG. 25. Adequate trimming weight is again applied to the roller 42 for efficient trimming of successive packages.

The driving of the scrap conveyor 43 at the same pulsating rate of the trimming drum 353 and trim roller 42 prevents undue tensioning of the scrap film thus minimizing the possibility of scrap breakage. As previously described, the conveyor 43 is driven directly from the trim roller 42 by the gear 400 carried on the shaft of the conveyor roller 397. The flat scrap 23 issues from the outer end of the conveyor 43 as illustrated in FIGS. 25 and 27. This scrap moves between a pair of vertically disposed gathering rollers 422 forming a part of the scrap disposal assembly 44 shown in FIG. 1. The rollers 422 as illustrated in FIG. 25 are each carried on a shaft 423 suitably rotatably journalled in a housing 424 mounted on the rear portion of the trimming assembly frame. The lower ends of the shafts 423 include bevel gears 425 suitably engaged with a drive gear 426 driven by a chain 427 extending to a sprocket 430 which in turn is connected by a chain 431 to the sprocket 361 of the main input shaft 360. The scrap film is gathered between the rollers 422 into a relatively thin continuous ribbon and conveyed over a pulley-type guide member 432 (FIG. 27) mounted for idling by brackets 433 on a frame portion. The scrap then is drawn downwardly from the pulley through a pair of engaging and driven rollers 434 which may be driven in any suitable manner such as by the shaft of the drive gear 426 (FIG. 25) extending transversely of the assembly. The scrap is then deposited in a waste container 45 as illustrated in FIG. 1.

FIGS. 28 and 29 illustrate further advantageous use of the special trim roller mounting and weighting arrangement. As previously described, the scrap film is removed from the trimming drum 353 between the engaging surfaces of the trim roller 42 and the scrap conveyor 43. When the packaging machine is started into operation, it is necessary to thread the film entirely through the same. The special trim roller mounting and weighting arrangement readily permits threading of the film between the trim roller 42 and conveyor 43. One of the supporting flange portions 391 of the frame 390 of the scrap conveyor 43 has attached thereto an operating handle 435 which when moved from the position shown in FIG. 28 to the position shown in FIG. 29 results in the pivoting of the frame 390 carrying the scrap conveyor 43. It will be recalled that the frame 390 is solely supported by the ear-like flange portions 391 from the carriage arms 385. Thus the entire conveyor 43 can be readily pivoted relative to the other elements of the assembly and such pivoting results in movement of the end of the conveyor including the roller 397 thereof downwardly and away from engagement with the trim roller 42. Adequate space is provided to readily thread the film onto the scrap conveyor 43. Reverse movement of the handle 435 results in proper positioning of the scrap conveyor in engagement with the trim roller, no special adjustments being required in order to bring about this appropriate engagement.

FIGS. 30–35 in conjunction with FIG. 26 illustrate the details of the structure and operation of the package ejection means 46. Referring first to FIG. 30, a plurality of Scotch yokes 436 are mounted within the hollow interior of the trimmer drum 353. Each Scotch yoke includes fixed to opposite margins thereof a pair of oppositely directed rods 374 on the outer ends of which are mounted the ejector means 46. With this arrangement a double acting ejector means is provided with oppositely directed ejector means of a single yoke extending through oppositely aligned die members 40. Each Scotch yoke is basically a generally elongated rectangular member having an interior captive rectangular slot. A sliding cam block 437 is received within each Scotch yoke and retained therein in rotatable relation about a transverse pin 450. Referring particularly to FIG. 26, each pin 450 is fixed to a crank arm 451 which in turn is fixed to one of the cam shafts 354. FIGS. 26 and 30 illustrate the projection of each ejector rod 374 through the cylindrical wall portion 373 of the drum 353. Each rod is slidingly received through a suitable gland 452 which establishes a seal to prevent loss of vacuum from the interior of the drum.

Referring to FIGS. 26, 32 and 33, it will be recalled that the drum 353 rotates with its sleeve relative to the cam shafts 354. The cam plates 365 rotate relative to the drum and the cam tracks 366 thereof control the pivoting of the cam shafts 354. Thus the positioning or change of position of the cam blocks 437 in the drum during rotation of the drum can effect a control on the operation of the Scotch yokes 436 and the positioning of the ejector means 46. FIGS. 32 and 33 are helpful in explaining the multiple operational features of the Scotch yokes 436. These illustrations are generally schematic and it will be noted that the ejector head portions are not included.

If the cover plate portions 373 were stationary and the cam shafts 354 were rotated, the Scotch yoke 436 would reciprocate as well as the ejector rods 374 fixed thereto. However, the trimming drum 353 rotates thus providing for rotation of the cover plate portions 373 thereof and the cam shafts 354 are generally stationary in a relative sense. This means that the Scotch yoke and rods will rotate with the drum and if the cam shaft 354 is maintained stationary, the Scotch yoke 436 will reciprocate along with rods 374. This provides for alternating extension and retraction of the respective rods 374 relative to the drum interior.

FIG. 32 illustrates the general vertical positioning of one of the Scotch yokes 436 and it will be noted that the generally fixed position of the crank arm 451 provides for a downward projection of the lowermost rod 374 and the retraction of the uppermost rod 374. This generally conforms with the package trimming and ejection operation in that the packages are received generally at the top portion of the trimming drum 353 as shown in FIG. 5A and are ejected therefrom along the bottom portion of the rotating path of the drum onto the labeler conveyor 47. FIG. 26 also illustrates the receiving of an untrimmed package in the top portion of the drum and the ejection of a trimmed package from the bottom portion of the drum. This then conforms with the general schematic illustration of the Scotch yoke 436 in FIG. 32. FIG. 33 illustrates the Scotch yoke 436 when the rods thereof are in a generally horizontal position during the intermediate portion of the path of rotation of the drum. Each rod is generally retracted within the drum, it being borne in mind that only the left-hand rod 374 as viewed in FIG. 33 has associated therewith a trimmed package as illustrated in FIG. 5A. The oppositely directed rod on the right-hand portion of FIG. 33 as viewed does not have any package associated therewith as the package previously received in that portion of the drum has already been ejected onto the labeler conveyor 47. Thus the position of the Scotch yoke 436 in FIG. 33 is that in which ejection at the left-hand side thereof is commencing and retraction in order to receive an untrimmed package is occurring along the right-hand portion thereof. However, the cam shaft 354 and crank arm 451 have remained in their original position.

FIG. 31 illustrates one of the cam plates 365 and the cam track 366 thereof. One of the cam rollers 372 of one of the cam shafts 354 is schematically shown in the track 366. It will be noted that substantially all of the cam track is of a generally circular configuration which is not concentric with the cam shaft 364 which functions to rotate the cam plate 365. In the generally circular portion of the track 366 with its eccentric relation the positioning of the crank arm 451 as shown in FIGS. 30, 32 and 33 is thus maintained, this position being slightly angled from a vertical position. The upper portion of the cam track 366 as viewed in FIG. 31 includes a generally flat area along

which the cam follower **372** will move during a complete rotation of the trimmer drum **353**. This flatted cam track area provides for controlled and limited pivoting or rotation of the cam shaft **354** so that slight movement of the crank arm **451** occurs with corresponding slight relative movement of the pin **450** and cam block **437** also occurring within the Scotch yoke. This slight movement provides for a "dwell" of the Scotch yoke in the package ejection position shown in FIGS. 26 and 32 so that the lowermost ejection rod **374** will remain fully extended during an adequate portion of the rotary path of movement. This "dwell" is also effective on the upper rod **374** to maintain the same fully retracted for an extended period. This period of extended retraction is timed to occur during the package trimming operation. In this manner the ejector means cannot be effective in any way to even slightly lift the package during the few seconds in which the same is trimmed.

Preferably, the "dwell" of the ejector means caused by limited pivoting of the cam shafts **354** will occur for approximately 45° of the rotation of the trimming drum **353**. Each ejector means **46** includes package engaging means of a type to be described to permit complete control over a package during vertically downwardly directed ejection thereof onto the labeler conveyor **47**. The "dwell" is of importance in that during this period complete seating of a package on the conveyor is obtained without danger of loss of control over package positioning during transfer. As the trimming drum **353** illustrated includes eight die members **40** and is of octagonal design, it is necessary to provide four double acting Scotch yokes **436**. Two of these yokes can be operated from a single pin **450** and a single cam shaft **354** with each Scotch yoke of the pair being arranged at 90° relative to one another as best illustrated in FIG. 30. This view of the interior of the trimming drum does not illustrate the additional pair of Scotch yokes to be used in providing the additional four ejection means. However, it will be noted from the positioning of the unused gland **452** that one of the remaining Scotch yokes will be placed at an angle of 45° relative to the two yokes illustrated. This means also that the remaining two yokes will be arranged in 90° relation relative to one another with each of the second pair being at 45° relative to the two Scotch yokes illustrated. The remaining pair of yokes are operated from the remaining cam shaft **354** at the right-hand portion of FIG. 26. This 45° variation between the pairs of yokes is the reason for the earlier reference to the fact that the individual cam shafts **354** are connected to their respective cam plates **365** in out of phase relation. In this manner proper timing of the operation of the various ejection means is obtained.

FIGS. 34 and 35 illustrate the means by which the ejectors **46** engage and control the packages during ejection thereof. It will be recalled that the interior of the trimmer drum **353** is evacuated through the passage **375** of one of the cam shafts **354** illustrated in FIG. 36. Each rod **374** at its connection with a Scotch yoke is formed with a central longitudinal evacuation passage **453** which is in communication with a lateral port **454** in a transverse plunger head **455** suitably fixed on the outer end of the rod **374** by a transverse set screw **456** which engages a flatted surface portion **457** of the outer end of the rod **374**. The port **454** is in communication with a transverse chamber **460** in the head **455** and which is sealed off at opposite ends by plugs **461**. The chamber **460** is in communication with a valve chamber **462** (FIG. 34) through a plurality of drilled ports **463**. A rotatable valve rod **464** extends through the valve chamber **462** and centrally thereof includes a pair of peripheral grooves **465** and **466**. Referring to FIG. 35 it will be noted that the peripheral groove **465** is of substantial extent approaching 180° circumferentially of the valve rod **464**. In the position illustrated this groove communicates the ports **463** with a port **467** extending into communication with an annular chamber **470** which in turn is in communication with the center of a resilient suction cup **471** through a plurality of ports **472** extending through a cup clamping plate **473** attached centrally to the head by a fastener **474**.

The valve rod **464** includes a transverse port **475** communicating the groove **465** with the groove **466**, the latter groove in the position illustrated being in communication with a plurality of outwardly extending venting ports **476**. With this position of the valve **464** the interior of the suction cup **471** is vented to atmosphere through the groove **466**, transverse port **475**, and groove **465** and ports **476**. At the same time, ports **463** are sealed off by valve rod **464** to cut off the vacuum from the continuously evacuated interior of the trimmer drum **353**. This is the package releasing position of the valve. Opposite ends of the valve rod **464** have attached thereto operating levers **477** and **480** the latter of which is substantially longer than the former.

As the interior of the drum **353** is continuously evacuated, vacuum is provided in the center passage **453** of each ejection rod **374** at all times. As the plunger head **455** is fully retracted into the associated die member **40** with sufficient space to accept a package of maximum thickness, as shown in the top portion of FIG. 26, the long lever **480** will engage the closure member **373** and will be cammed into approximate coplanar relation with the side of the head **455**. This results in the rotation of the valve **464** to move the groove **465** out of communication with the venting ports **476** and to bring said groove **465** into communication with the port **463**. This also moves the smaller groove **466** into communication with port **467** to evacuate the chamber **470** and the interior of the suction cup **471** through transverse port **475**. Under these circumstances a package introduced into the die member **40** will become gripped by the suction cup **471** of the associated ejection means and held thereby within the die member upon contact with a package surface. The position of the ejection means at this particular portion of the operation is such that the package is properly positioned for trimming. Following trimming as previously described, the particular ejection means is progressively projected outwardly from its associated die member to engage and to grip the package by vacuum means for controlled trimmed package delivery onto the labeler conveyor **47**. This sequence of operation is best illustrated in FIG. 5A. The vacuum is maintained within the cup **471** and the package is fully retained on the plunger head. Ultimately the package is brought into complete stable register with a spring mounted platen **481** (FIGS. 5A and 30) carried on the labeler conveyor **47**. In properly timed relation the shorter valve operating lever **477** which is in upwardly and rearwardly projecting position engages a fixed rod **482** projecting from one of the side housing portions **356** and the valve **464** is rotated into the vacuum release position illustrated in FIG. 35. In this position the package is released from the suction cup **471** and the package remains deposited on the associated labeler platen **481**. The labeler conveyor **47** is operated in timed relation with the trimming drum so that smooth and efficient package transfer is obtained. The labeler conveyor then carries the packages through the labeler **51** as shown in FIGS. 1, 5A and 15B. Spring loaded platen **481** is effective in providing labeling pressure for a range of package thickness variations and surface irregularities, yet is made to provide positive label position registry.

The drive arrangement for the trimmer roller **42** is best illustrated in FIGS. 36 and 37. As previously described in FIG. 27, the trimmer roller **42** includes a drive sprocket **401** which engages the chain **402** which is fixed on one outer side margin of the trimmer drum **353**. This chain arrangement is in the form of an octagonal gear which is schematically illustrated in FIG. 37. The octagonal flat surface shape of the drum **353** provides for the pulsating drive action as previously described, this drive

action being transmitted to the roller 42 through the sprocket and chain arrangement illustrated. The drive roller 397 for the scrap conveyor 43 includes the drive gear 400 engaged with the sprocket 401 of the trim roller 42. This particular gear can also be made of a roller chain comparable to the chain 402 carried on the drum 353 thereby providing for a corresponding drive arrangement between the various elements. The use of a drive chain 402 with the sprocket 401 in the manner described insures a positive drive connection at all times even though pulsating operation occurs. This also insures a positive transmission of the surface speed of octagonal surfaces 483 of drum 353 to roller 42 and to drive roller 397 of scrap conveyor without any slippage.

Referring again to FIGS. 27 and 36, each flatted surface portion of the trimmer drum 353 includes a flat cam surface portion 483 mentioned earlier which is engaged with an annular surface portion 484 forming a part of the trim roller 42. These engaging surfaces are located to each side of the die member 40. These mating surfaces of different configuration are pressure surfaces which prevent the direct contact between the central film engaging portion of the roller 42 and each die member 40, however, the cutting edge of the die must be adjusted extremely close to the surface of the pressure roller 42 in order to cut thin films. The wear on the cutting edges of die members 40 is caused only by the film or base member being severed from film 23. The engaging surfaces 483 and 484 not only prevent direct contact with the roller against the die member, but also further conform with the pulsating operation of the engaging elements. The use of a flat surfaced trimming drum is of substantial significance for flat based packages from the standpoint of permitting the use of flat and fixed die members. A flat die member is more readily sharpened and is less expensive than a contoured die member. It is less expensive and less complicated to have a fixed die member as distinguished from using an emerging or movable cutter. By providing for completely flat cutting of the film, a more uniformly trimmed package is obtained and complete and exact registry between the cutter and film is obtained without stretching or without the problem of "creep."

Each die member 40 is adjustably and removably mounted on the drum 353 as shown in FIGS. 36 and 38. The die member 40 includes an annular radial bottom flange 485 through which circumferentially spaced threaded sleeves 486 are received. These sleeves are threadedly adjustable in the flange 485 to vary the height of the cutter relative to the drum. These sleeves function as jack screws. An inverted cup-shaped locking member 487 is received over the top of each sleeve 486 and carries a locking pin 490 which projects downwardly into a locking slot 491 of the sleeve. The locking member 487 is held in place by a fastener 492 extending downwardly through the sleeve 486 and threadedly received in a surface portion 493 of the drum. This mounting arrangement provides ready adjustment of the die member and prevents warping or distortion of the cutting edge surface of the die member during adjustment and tightening of fastener 492.

It will be borne in mind that when the gripper chains 133 leave the package forming drum 136 they are in inverted position thus placing the jaw member operating cam rollers 162 (FIG. 7) in an elevated position as illustrated in FIG. 36. Simultaneous with the trimming of each package, the trimmer roller 42 functions to unlock the jaw members of the gripper chains. The unlocking action is brought about by a reversal of the locking action previously described. The trimmer roller 42 includes a pair of laterally spaced cam rings 494 illustrated in FIG. 36 as mounted on the pressure surfaces 484. These cam rings are located just inwardly of the drum pressure surfaces 483 and are arranged for engagement with the cam rollers 162 of the chain links as illustrated in FIG. 36. The camming rings 494 are of such a diameter that they will fully actuate cam roller 162 into the locked-open position. With the full opening of the jaw members the gripper chains completely clear the side margins of the scrap film and this film can be readily removed on the scrap conveyor 43 as previously described. The trimmer roller 42 additionally includes at the end thereof opposite the end carrying the sprocket 401 a guide disc 495 (FIGS. 27 and 36) which is received in a recess 496 formed in the margin of the drum 353 opposite to the margin carrying the chain 402. The guide disc 495 cooperates with the drum to maintain proper transverse alignment of the trimmer roller 42 relative to the drum.

FIG. 39 illustrates the unitary drive arrangement for the packaging machine described. Preferably the various assemblies of the machine will be subject to a single drive arrangement for purposes of maintaining synchronized movements of the various inter-related devices. The basic drive arrangement includes a main drive motor 497 capable of adjustable speed control to vary the rate of machine operation when desired. A gear box 500 includes an output shaft 501 from which a plurality of chain drives extend to another shaft 502. One end of the shaft 502 includes a gear take-off unit 503 for driving the labeler conveyor 47. The gear unit 503 also drives the main input shaft 360 of the package trimming assembly 140. The shaft 360 includes the gear 362 engaged with the cam shaft gear 363 carried on the cam shaft 364. The gear 367 carried on the cam shaft 364 engages the gear 370 which drives the trimmer drum 353. The cam plates 365 of the ejector means are illustrated in FIG. 39 for driving by the shaft 364. The out of phase relation of the cam rollers 372 for the Scotch yokes 436 is also illustrated. The main input shaft 360 also includes the take-off sprocket 361 which is chain connected to the film support roller 132 (FIG. 5A) to drive the same and is also connected to the main drive sprocket 96 of the water tank assembly 10.

The shaft 502 is gear connected to the main drive shaft 202 of the package forming drum 136. The shaft 202 also carries the sprockets 291 and 292 of the transfer arm assembly 252. The shaft 202 carries the shaft 195 of the idler drum 135 including the tensioned arm 201. The chains 295 of the transfer arm assembly 252 drive the sprockets 293 and 294 and the shaft 256 which in turn drives the head sprocket assembly 254. The drive chain 191 of the film pick-up reel 194 extends from a sprocket on the driven shaft 256 into engagement with the half sections of the reel 134 as previously described.

The shaft 501 includes a belt drive 504 which is attached to a drive gear 505 engaging the drive gear 506 of the labeler 51. From this over-all drive arrangement it can be seen that the various assemblies of the machine are cooperatively arranged for concurrent uniform operation using a single power source.

FIGS. 5A and 5B illustrate the packages confined within the film 23 being transferred from the package forming drum 136 to the package trimmer assembly 140 by the gripper chains 133. During this portion of travel of the gripper chains, the chains themselves may be supported by the members 137 if desired but the packages are merely supported by the film 23. Depending upon the size of packages being formed and/or the weight of the packages, it may be desirable to provide means for direct support of the individual package during the conveying of the same from the package forming drum to the trimmer assembly. A suitable package conveying system is shown in FIGS. 40–44.

FIG. 40 illustrates schematically an overhead package engaging conveyor system 507 including a plurality of pivotally interconnected package engaging members 510. This endless system extends over a pair of suitable sprockets 511 which may either be driven or may be idlers on

shafts 512. The sprockets 511 are provided with a plurality of outwardly extending arcuate portions or seats which engage rollers 520 of each package engaging member 510. The package engaging members move about the right-hand sprockets 511 into overlying engagement with the chain links 142 along the top portion of the package forming drum 136 after the packages have been formed and just immediately prior to separation of the packages from the cavities of the drum 136 by the gripper chains 133. The combined package conveyor system 507 and gripper chains 133 extend continuously from the package forming drum 136 into engagement with an idler sprocket 513 mounted on a shaft 514 and including a plurality of outwardly extending arcuate seat portions 515 which engage rollers 143 on gripper chains 133. Immediately upon leaving the idler drum 513 for the trimming drum 140 the package engaging members 510 are disengaged from the packages and chain links 142 and the gripper chains 133 convey the packages and film 23 the remaining short distance to the trimmer drum 140 by means of the gripper engagement at the film margins. The disengaged members 510 are then returned in inverted position about the left-hand drum 511 to the right-hand drum 511 for re-engagement with gripper chains 133 and with successive packages.

FIGS. 41–44 illustrate the details of a package engaging member 510. Each member includes a transverse central plate portion 516 of generally wing-shaped silhouette and having suitably attached thereto along opposite end margins depending straight links 517. As best shown in FIGS. 43 and 44 the links 517 of adjacent members 510 are pivotally interconnected by small rollers 520. The links 517 are of a length equal to the links 142 of the gripper chains 133 thus placing the axis of rollers 143 in transverse internal coincident alignment with rollers 520. In this manner the articulation of the conveyor 507 corresponds exactly to that of the gripper chains 133 and each package engaging member 510 is of sufficient width to be fully received over a pair of transversely aligned gripper chain links 142.

The plate 516 includes a pair of longitudinally projecting bars 521 along one edge thereof with each bar carrying a transverse plate 522 to which a roller shoe 523 is mounted in overlying engagement with a roller 143 of a gripper chain link. In FIGS. 43 and 44 it will be noted that two shoes 523 are provided with each member 510, the next adjacent pair of rollers 143 being engaged by shoes of the next adjacent package engaging member 510. The shoes 523 aid in obtaining and maintaining proper alignment and engagement of the gripper chain links with the package engaging members. To further aid in this respect the plate 516 additionally has mounted thereon a pair of transversely spaced magnets 524 in engagement with the chain links 142 and clamping the same to the undersurface of the member 510 as best shown in FIG. 41. The magnets 524 are of sufficient strength to hold the underlying chain links 142 to the overlying plate 516 but yet permit ready separation thereof in the manner to be described.

The central bottom surface of the plate 516 has formed thereon a depending rim 525 which centrally thereof has positioned therein a suction cup 526 mounted on a reciprocating rod 527 suitably journalled through a sleeve 530 extending through the plate 516. The rod 527 is adapted for reciprocation through the sleeve 530 and a coil spring 531 acts between the sleeve 530 and a washer 532 fixed to the rod. The rod 527 includes a longitudinal port 533 centrally thereof which communicates through a centrally drilled fastener 534 attaching the cup 526 to the rod. The upper extension of the port 533 is in communication with a transverse port 535 which extends to the surface of the rod.

The top portion of the rod 527 carries thereon a transverse wing member 536 carrying at the opposite outer ends thereof cam rollers 537. The wing member 536 internally thereof includes an O-ring 540 which surrounds the rod in the area of the transverse port 535 to seal off the same. As best shown in FIGS. 42–44, the wing member 536 also includes a longitudinally extending limit plate 541 suitably carried by spaced vertical pins 542 threadedly receiving lock nuts 543 thereon which adjustably control the vertical positioning of the plate 541. The top end of the rod 527 is of reduced diameter and is received through a central aperture in the plate 541. A stop collar 544 is fixed to the top end of the rod 527 to limit the extent to which the wing member 536 can be raised thereon. The fixed washer 532 limits the extent to which the wing member 536 can move downwardly on the rod. The vertical alignment of the wing member on the rod is maintained by a guide pin 545 suitably fixed to the plate 516 and extending upwardly through a slotted portion 546 of the wing member 536.

When a package engaging member 510 is brought into overlying engagement with a pair of chain links 142 at the package forming drum 136 as shown in FIG. 40, a downwardly pressing cam 547 receives the cam rollers 537 to move wing member 536 downward relative to the rod 527 to cause O-ring 540 to seal off port 535 and to force the air from the cup 526 by the pressure of engagement. This downward movement results in the cup 526 projecting below the rim 525 and engaging the bottom surface of the base member 30 of the inverted package which is supported in the package forming drum 136. Spring 531 urges rod 527 and cup 526 upwardly to hold the base member 30 of the package against the outer surface of the rim 525. During this sequence of operation the magnets 524 adequately engage the chain links 142 and the entire gripper chain assembly is confined within and attached to the package conveying assembly 507 with each individual package being supported in the position described independent of the gripper chains which merely support the film.

Following movement of the combined chain links and package engaging members from the idler drum 513, a suitable camming arrangement can be used to release the package from its engaging member 510. For example, a cam 551 can receive the cam rollers 537 thereover to either lift or hold the same in position. If the cam rollers are merely supported, an additional overhead cam 552 can be relied upon to depress the rod 527 sufficiently to expose the port 535 thereby releasing the package from the cup 526 by introducing atmospheric pressure into the cup.

Obviously certain modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A package forming machine comprising a continuous film supply means, an endless film conveying means engaging said film for movement therewith, package forming means receiving said film and engaging said conveying means, said package forming means including an endless series of package forming cavities into which said film is received, product supply means engaging said package forming means and including movable platen means delivering products into successive cavities in which said film is received and closing off said cavities to form packages therein, said film conveying means extending continuously from said package forming means and conveying said film with a series of packages formed therein, package trimming means engaging said film conveying means and including an endless series of die means receiving successive packages therein, pressure means in the path of movement of said die means and engaging said film therewith to separate packages therefrom, separated package receiving means associated with said trimming

means, means separating film scrap from said conveying means located between said trimming means and the area of engagement of said conveying means with said film in the path of movement of said conveying means, and drive means for at least one of said conveying means, package forming means, and package trimming means.

2. The package forming machine of claim 1 wherein said film supply means includes extruder means delivering film through driven roller means to said conveying means, said roller means being mounted on adjustable support means to vary the distance between said extruder means and roller means whereby the tension on said film is varied to change the width and thickness thereof.

3. The package forming machine of claim 1 wherein said film conveying means is of chain-like arrangement with laterally spaced link portions thereof having jaw means gripping opposite marginal portions of said film to convey said film.

4. The package forming machine of claim 1 wherein said film conveying means is of chain-like arrangement with laterally spaced link portions thereof having jaw means gripping opposite marginal portions of said film to convey said film, first operating means for said jaw means to close the same in film gripping relation, said first operating means engaging said conveying means in the area of engagement of said conveying means with said film in the path of movement of said conveying means, and second operating means for said jaw means associated with said trimming means in an area of the path of movement of said conveying means adjacent said pressure means, said second operating means opening said jaw means to release film scrap from said conveying means.

5. The package forming machine of claim 1 wherein said product supply means further includes an endless conveyor having a series of tray means supporting products in inverted position with package base members on top of said products, and transfer drum means receiving said conveyor and guiding the same downwardly and rearwardly along an arcuate path to invert said tray means, said platen means being positioned relative to said drum means to move along said arcuate path outwardly and below said tray means to receive said products thereon in upright position for transfer to said cavities.

6. The package forming machine of claim 1 wherein said products supply means further includes an endless conveyor having a series of tray means supporting products in inverted position with package base members on top of said products, transfer drum means receiving said conveyor and guiding the same downwardly and rearwardly along an arcuate path to invert said tray means, said platen means being positioned relative to said drum to move along said arcuate path outwardly and below said tray means to receive said products thereon in upright position for transfer to said cavities, and reciprocating piston means in said drum means and aligned with said tray means to engage said products during transfer thereof to said platen means.

7. The package forming machine of claim 1 wherein said package trimming means is in the form of a rotatable drum with said die means arranged peripherally thereon, and ejection means in said drum in the form of reciprocating pistons which are movable through said die means subsequent to engagement of said film therewith in response to said pressure means.

8. The package forming machine of claim 1 wherein said package trimming means is in the form of a rotatable drum with said die means arranged peripherally thereon, ejection means in said drum in the form of reciprocating pistons which are movable through said die means subsequent to engagement of said film therewith in response to said pressure means, said pistons including vacuum impressing means forming a part thereof to engage and support a separated package during ejection thereof from a die means, and package labeling means associated with said trimming means and including conveyor means operated by said drive means and receiving separated packages thereon below said drum, said packages being deposited on said conveyor means in controlled position by operation of said pistons and the vacuum impressing means forming a part thereof.

9. The package forming machine of claim 1 wherein said film conveying means in the area of the path of movement thereof between said package forming means and package trimming means combines with an endless series of package engaging and support means to carry the weight of said packages.

10. The package forming machine of claim 1 wherein said film conveying means in the area of the path of movement thereof between said package forming means and package trimming means combines with an endless series of package engaging and support means to carry the weight of said packages, each of said engaging and support means comprising vacuum impressing means engaging the top surface portion of a package to suspend the same along the path of movement of said conveying means, and package release means in said path of movement and operative with said engaging and support means to release said packages for the receiving thereof by said die means.

11. In a package forming machine wherein a continuous film is delivered to a package forming means by marginal gripping means and thereafter with a series of packages formed therein is delivered by said gripping means to trimming means for package separation, the provision of package engaging and support means overlying the path of movement of said gripping means between said package forming means and trimming means, said engaging and support means comprising a series of pivotally interconnected vacuum impressing members each including reciprocating piston means to engage a top portion of a package, means forming a part of said piston means to impress a vacuum on said package to support the same in suspended relation and for continued movement with said gripping means, operating means engaging said piston means to separate the same from said package, and drive means for said series to move the same with said gripping means.

12. The package engaging and support means of claim 11 wherein each piston means includes a suction cup for package engagement, valving means controlling pressure equalization in said cup, and operating means for said valving means.

13. A device for supercooling and dimensioning polyvinylidene chloride film comprising a water tank for direct association with a continuous film extruder, driven roller means extending transversely of said tank to receive film from an extruder and move the same through said tank during which movement said film is immersed in a supercooling water bath maintained in said tank, power means attached to said tank to support and move the same toward and away from an extruder in a generally vertical arcuate path, base means fixed relative to said tank and carrying a drive source, drive means interconnecting said drive source with said roller means, and pivotal parallel linkage means interconnecting said tank with said base to control the movement of said tank along said path which is at least centered about said drive source to maintain drive transmission during movement of said tank.

14. The device of claim 13 wherein the drive arrangement for said roller means which includes said drive source and drive means comprises means operative to permit movement of said roller means relative to said drive source while maintaining a positive drive connection therewith and with said drive means.

15. The device of claim 13 wherein said power means is in the form of a double acting cylinder pivotally connected to said tank at one end thereof and pivotally mounted to a fixed back-up means.

16. In a package forming machine wherein a continuous film is supplied to package forming means along a prescribed path of movement, the provision of a film combining and conveying assembly comprising a rotatable reel means including sprocket-like support means, film gripping means in the form of an endless chain-like arrangement having pairs of laterally spaced link means including pivotal interconnections, said gripping means combining with said reel means along a peripheral portion thereof which is in said path of movement with the pivotal interconnections of said link means engaging said support means, and film supply means feeding said film into combining relation with said reel means and gripping means along said peripheral portion and between the link means of said gripping means, each link means including jaw means for the gripping of marginal portions of said film, said reel means having operating means for said jaw means to close the same in film gripping relation upon the combining of said film, gripping means and reel means.

17. The film combining and conveying assembly of claim 16 wherein said operating means is a driven cam actuating means fixed relative to said reel means for successive operation of the jaw means of said gripping means during rotation of said reel means, drive means for said cam actuating means, said jaw means including cam follower means engageable with said cam actuating means to close said jaw means.

18. The film combining and conveying assembly of claim 16 wherein said reel means includes transverse and outwardly projecting rim-like portions aligned with said sprocket-like support means to engage said film transversely thereof in the areas of the pivotal interconnections of said link means to provide flat sections of said film between adjacent rim-like portions for ready gripping of said film by said jaw means.

19. In a package forming machine wherein a continuous film is supplied to package forming means along a prescribed path of movement, the provision of a product supply assembly to deliver successive products to said package forming means into said path of movement, said product supply assembly comprising endless conveyor means including a series of spaced product trays in continuous movement about the periphery of a rotatable product displacement means, said continuous movement extending along an arc of about 180° whereby each product is inverted upon reaching the end portion of said arc, product transfer means aligned between said displacement means and said package forming means to transfer successive products to said package forming means, said transfer means including at least one pivotally mounted arm having a product support means which in turn is pivotal relative to said arm, and operating means for said arm to pivot the same into association with said product displacement means to receive a product in supported relation on said support means at the end portion of said arc and to pivot said arm into association with said package forming means to transfer a product to said package forming means while supporting said product on said support means.

20. The product supply assembly of claim 19 wherein said product transfer means comprises an endless series of pivotally mounted transfer arms, said prescribed path of movement in the arcuate continuous movement of said product displacement means being parallel with said transfer means located therebetween in paralleling relative movement, said arms being transversely pivotal along an arcuate path from below said displacement means to below said package forming means, the support means of each arm being pivotally carried thereby outwardly thereof and during movement along the arcuate path of said arm providing for the lowering of a product from said displacement means and the raising of the product for transfer to said package forming means.

21. The product supply assembly of claim 19 wherein said displacement means is in the form of a drum having a plurality of reciprocating plunger means arranged along the periphery thereof in alignment with said trays, and cam means engaged with said plungers to extend the same into engagement with said products during said arcuate continuous movement to displace said products from said trays onto said support means.

22. The product supply assembly of claim 20 wherein said displacement means is in the form of a drum having a plurality of reciprocating plunger means arranged along the periphery thereof in alignment with said trays, and cam means engaged with said plungers to extend the same into engagement with said products during said arcuate continuous movement to displace said products from said trays onto said support means.

23. In a package forming machine having as a part thereof a rotating package forming means provided with product and film receiving cavities and vacuum impressing port means for use in collapsing said film about said product, and product supply means related to said package forming means from which products are transferred to said package forming means, the provision of a product transfer assembly comprising at least one projecting arm pivotally mounted on drive means for oscillating transverse movement, product support means pivotally mounted on said arm toward the outermost end thereof for movement about an axis which is parallel to the axis of movement of said arm, said support means being dimensioned to receive a product from said supply means in supported relation on a surface portion thereof and to inject the product into a cavity and close off said product for package forming and evacuation, finger means projecting from said support means and defining therein a vacuum passage communicating with the product receiving surface portion of said support means and arranged for communication with said port means when said support means closes off a cavity, and control means extending between said arm and support means to maintain said support means in underlying supporting engagement with a product when said arm is oscillated by said drive means during product transfer from said supply means to said package forming means.

24. The product transfer assembly of claim 23 which comprises a plurality of transfer arms interconnected in an endless series for movement about cam track means forming a part of said drive means, cam follower means engaged with said cam track means to oscillate said arms during a portion of said movement, said control means including a portion fixed relative to each of said arms and an interconnected portion fixed to said support means, whereby oscillating movement of said arm provides for independent pivoting of said support means.

25. In combination, a package forming means including an outer surface portion against which a packaging film is to be received, a package forming cavity in said surface portion adapted to receive film therein and a product, vacuum means in communication with said cavity to draw said film therein and in communication with port means on said surface spaced from said cavity, product delivery means in the form of cavity closure plate means adapted to support a product thereon and insert the same into said cavity in sealing engagement with said surface, said plate means including projecting finger means to engage said port means, said finger means and plate means having internal passages for communication with said port means to evacuate an assembled package in said cavity, and drive means for said delivery means to move said plate means into and out of register with said cavity.

26. The combination of claim 25 wherein said cavity includes a yieldable piston means therein defining the bottom thereof, resilient means engaging said piston for re-

traction thereof upon the insertion of a product in said cavity, and operating means for said piston to reciprocate the same in said cavity to eject a package therefrom.

27. In combination, a package forming means including an outer surface portion against which a packaging film is to be received, a package forming cavity in said surface portion adapted to receive film therein and a product, vacuum means in communication with said cavity to draw said film therein and in communication with port means on said surface spaced from said cavity, product delivery means in the form of cavity closure plate means adapted to support a product thereon and insert the same into said cavity in sealing engagement with said surface, said plate means including projecting finger means to engage said port means, said finger means and plate means having internal passages for communication with said port means to evacuate an assembled package in said cavity, laterally spaced chain-like means clamping a film therebetween and overlying said surface with said film extending over said cavity, and drive means for said delivery means and chain-like means to move the same in synchronized relation relative to said cavity.

28. The combination of claim 27 wherein said package forming means is in the form of a rotatable drum provided with a plurality of circumferentially spaced cavities on the periphery thereof, said drive means being engaged with said drum for rotation thereof which is synchronized with said delivery means and chain-like means.

29. The combination of claim 27 wherein said package forming means is in the form of a rotatable drum provided with a plurality of circumferentially spaced cavities on the periphery thereof, said drive means being engaged with said drum for rotation thereof which is synchronized with said delivery means and chain-like means, said chain-like means including a plurality of pivotally interconnected straight link means carrying jaw means clamping marginal portions of said film and maintaining the clamped film sections in flat sheet-like condition, the periphery of said drum having a series of flat areas each of which includes a cavity, said film sections and flat areas being in register and at least substantially co-extensive.

30. The combination of claim 27 wherein said cavity includes a yieldable piston means therein defining the bottom thereof, resilient means engaging said piston for retraction thereof upon the insertion of a product in said cavity, and operating means for said piston to reciprocate the same in said cavity to eject a package therefrom.

31. In combination, a package forming means including an outer surface portion against which a packaging film is to be received, a package forming cavity in said surface portion adapted to receive film therein and a product, vacuum means in communication with said cavity to draw said film therein, laterally spaced film clamping means holding opposite side margins of a film section in overlying side marginal sealed relation with said cavity, and transverse resilient vane means engaging said film section along opposite end margins thereof and pressing the same into sealed relation about said cavity, whereby operation of said vacuum means stretches said film into said cavity.

32. The combination of claim 31 wherein said package forming means is in the form of a rotatable drum provided with a plurality of circumferentially spaced cavities on the periphery thereof, and rotatable reel-like means carrying a plurality of said vane means in outwardly projecting relation for successive engagement with end margins of film sections and sealing thereof against said drum.

33. The combination of claim 31 wherein said package forming means is in the form of a rotatable drum provided with a plurality of circumferentially spaced cavities on the periphery thereof, said film clamping means being in the form of chain-like means including a plurality of pivotally interconnected straight link means carrying jaw means clamping spaced sections of a continuous sheet of film and maintaining said sections in flat condition, the periphery of said drum having a series of flat areas each of which include a cavity, said film sections and flat areas being in register and at least substantially co-extensive, drive means for said drum and chain-like means to provide continuous synchronized movement thereof in temporary combining relation, and rotatable reel-like means carrying a plurality of said vane means in outwardly projecting relation for successive engagement with end margins of film sections and sealing thereof against said drum, said reel-like means including means engaging said chain-like means for movement therewith and with said drum.

34. In a package cut-out assembly wherein successive packages are delivered into a series of circumferentially spaced pockets along the outer surface of a rotating drum with each pocket including projecting cutting means arranged peripherally thereof, said drum having package ejector means in communication with each pocket, said assembly including drive means for rotating said drum in synchronized relation with continuous package delivery so that packages are received in said pockets with peripheral packaging material thereof overlying said cutting means, and pressure means engaging successive cutting means to trim each package, the improvement comprising said pressure means being in the form of a roller engaging the periphery of said drum, said roller being carried by a movable carriage mounted for roller pressure relieving movement away from said drum, and package sensing means positioned in the path of package movement with said drum, said sensing means including operating means engaged with said carriage to move the same in response to an interruption in successive package delivery to said drum.

35. In a package cut-out assembly wherein successive packages are delivered into a series of circumferentially spaced pockets along the outer surface of a rotating drum with each pocket including projecting cutting means arranged peripherally thereof, said drum having package ejector means in communication with each pocket, said assembly including drive means for rotating said drum in synchronized relation with continuous package delivery so that packages are received in said pockets with peripheral packaging material thereof overlying said cutting means, and pressure means engaging successive cutting means to trim each package, the improvement comprising said package ejector means being in the form of reciprocating rods having package engaging head portions movable through said pockets, and package holding means forming a part of said ejector means to provide for retention of a package during ejection thereof from a pocket for controlled repositioning of said package on a surface which is independent of said drum.

36. The package cut-out assembly of claim 35 wherein timing means are connected to said ejector means and include cam means controlled by the rotation of said drum to provide dwell periods for said ejector means both during the positioning and trimming of packages in said pockets and during ejection of said packages when said head portions are at the outermost end of their movement through said pockets.

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