Sept. 16, 1969 E. J. SCHAEFER ET AL 3,466,849

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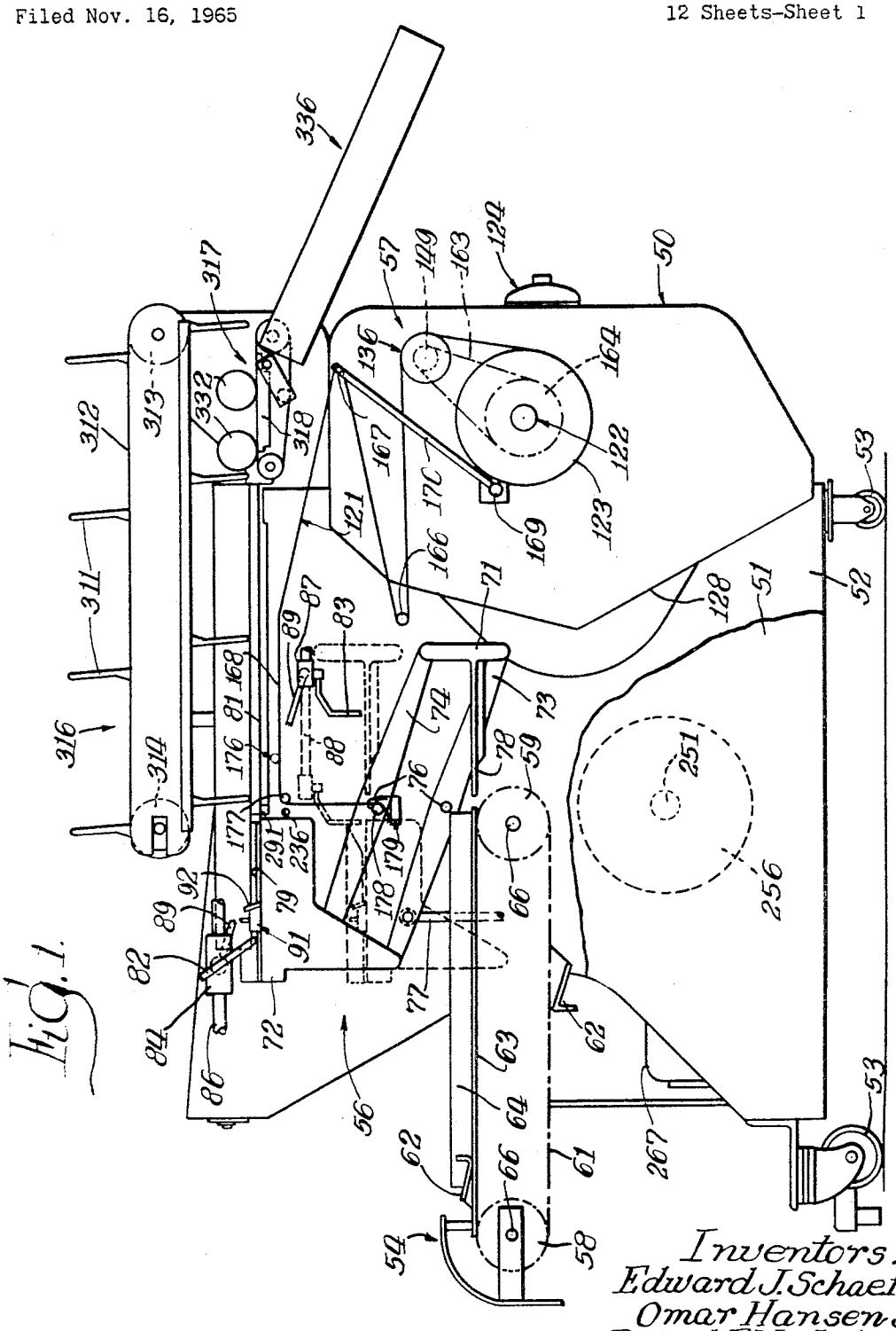


Fig. 1.

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Edward J. Schaefer,
Omar Hansen Jr.,
Robert F. McVicker,
By Hibben, Noyes & Bicknell
Attys.

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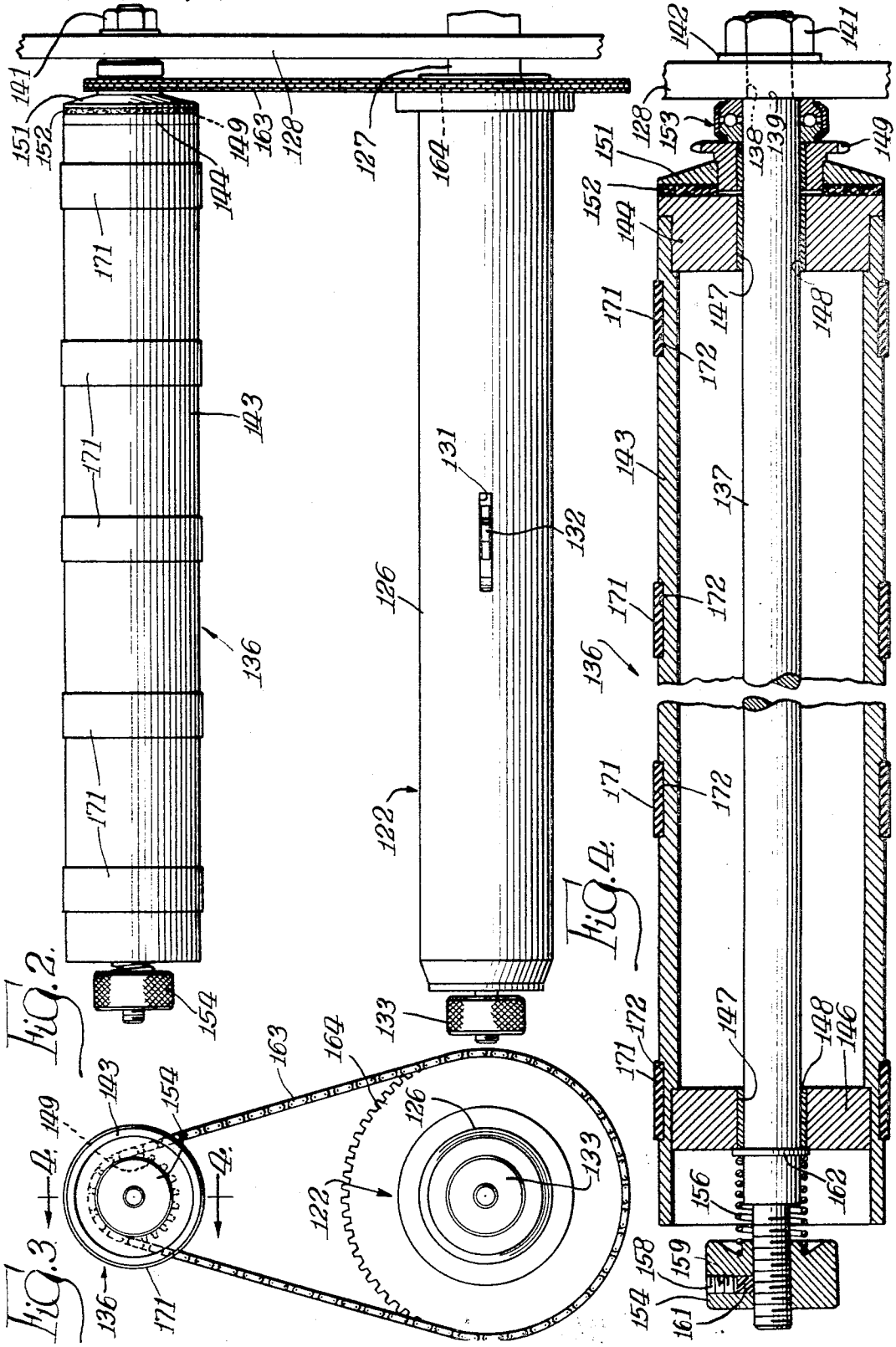


FIG. 2.

FIG. 4.

FIG. 3.

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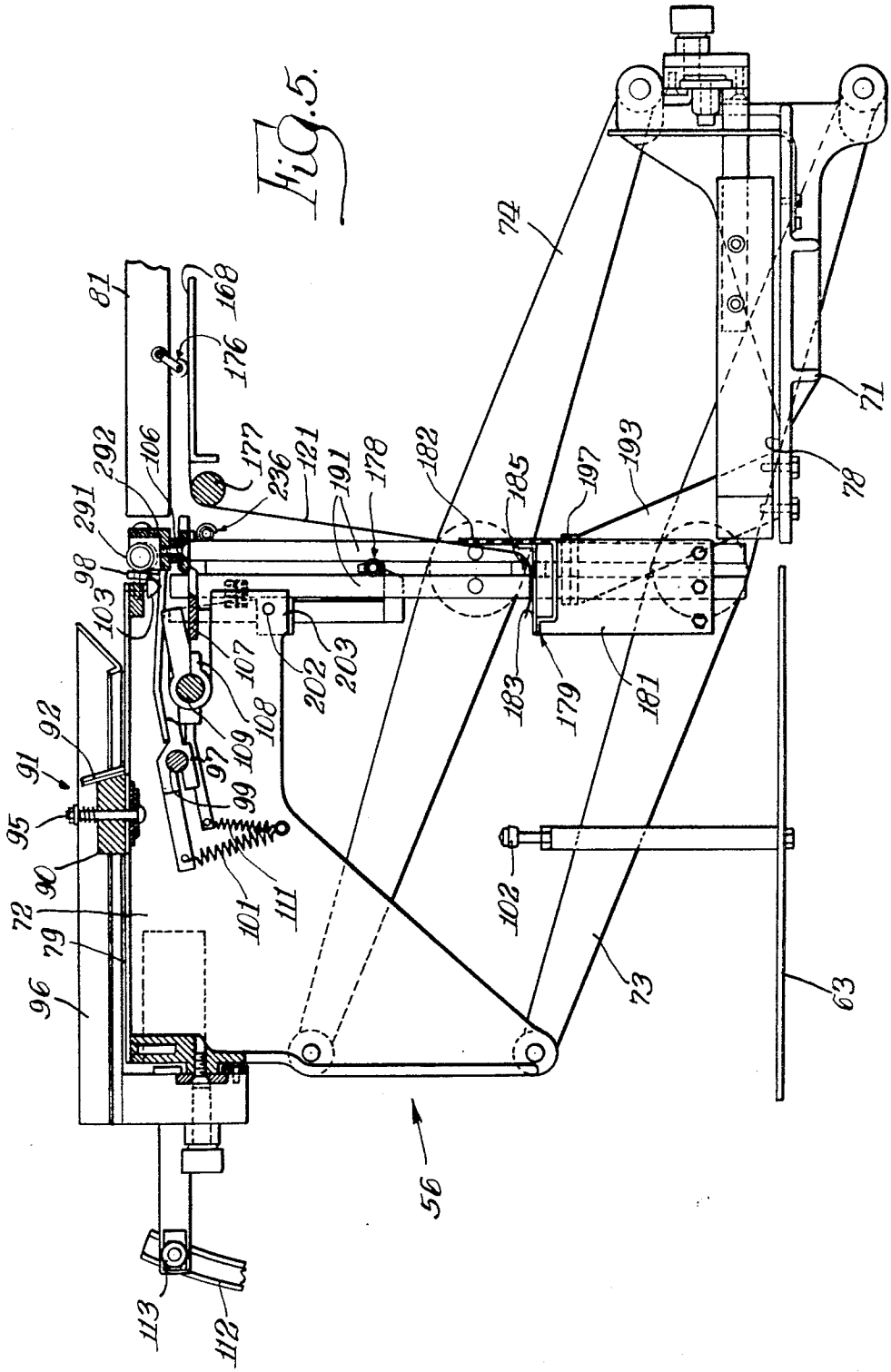
FIG. 5.



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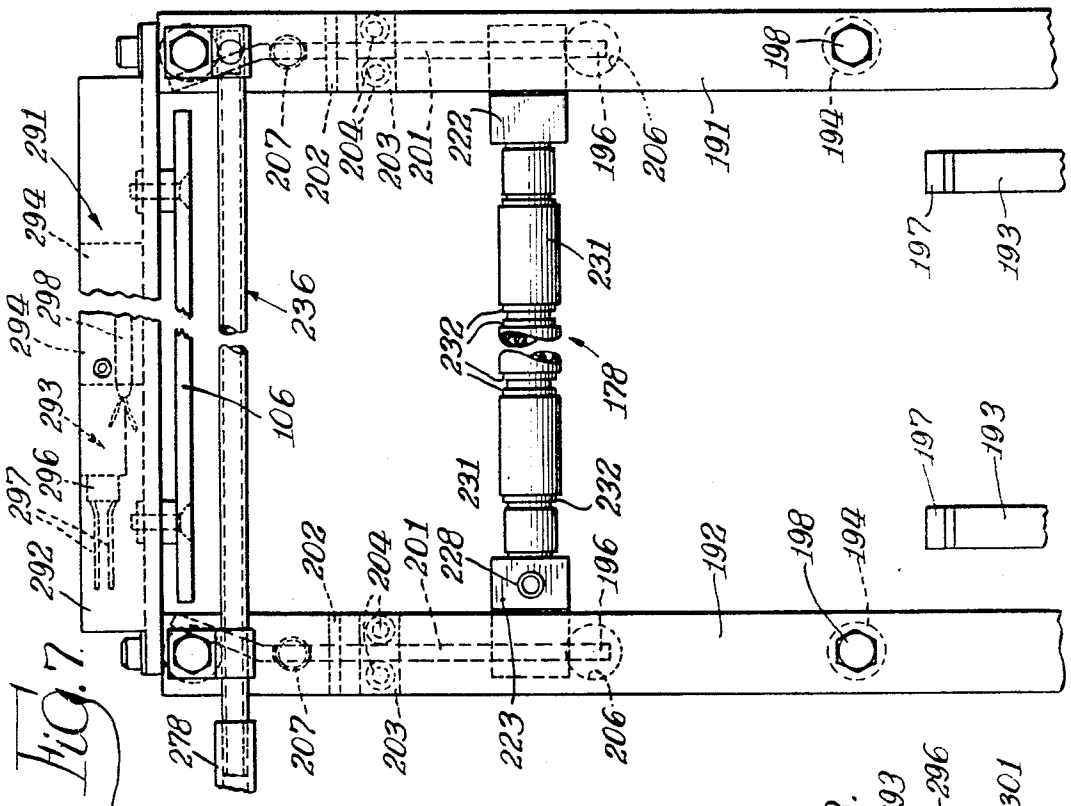

FIG. 7.

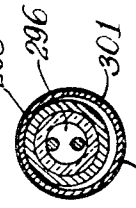

FIG. 8.



FIG. 6.

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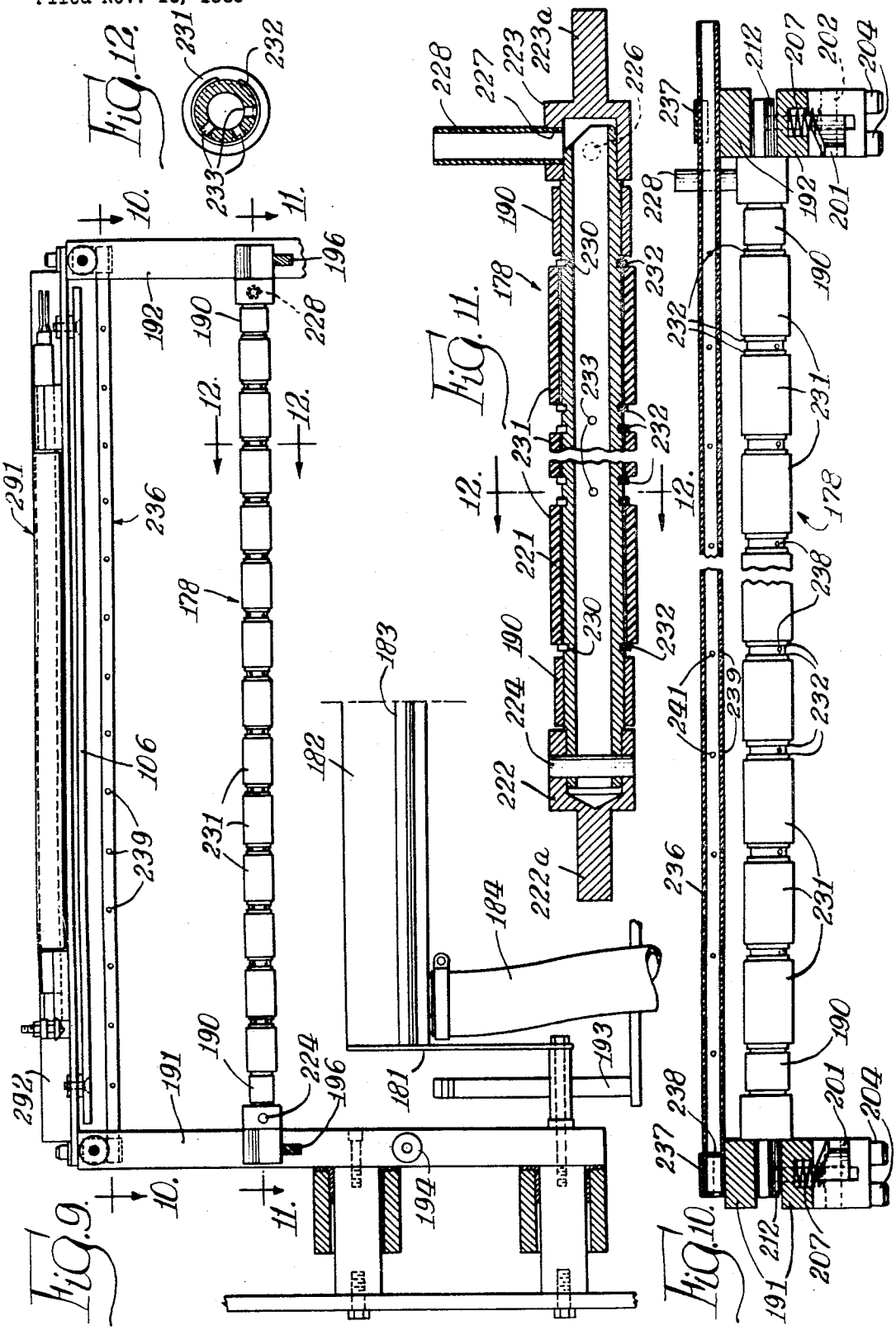

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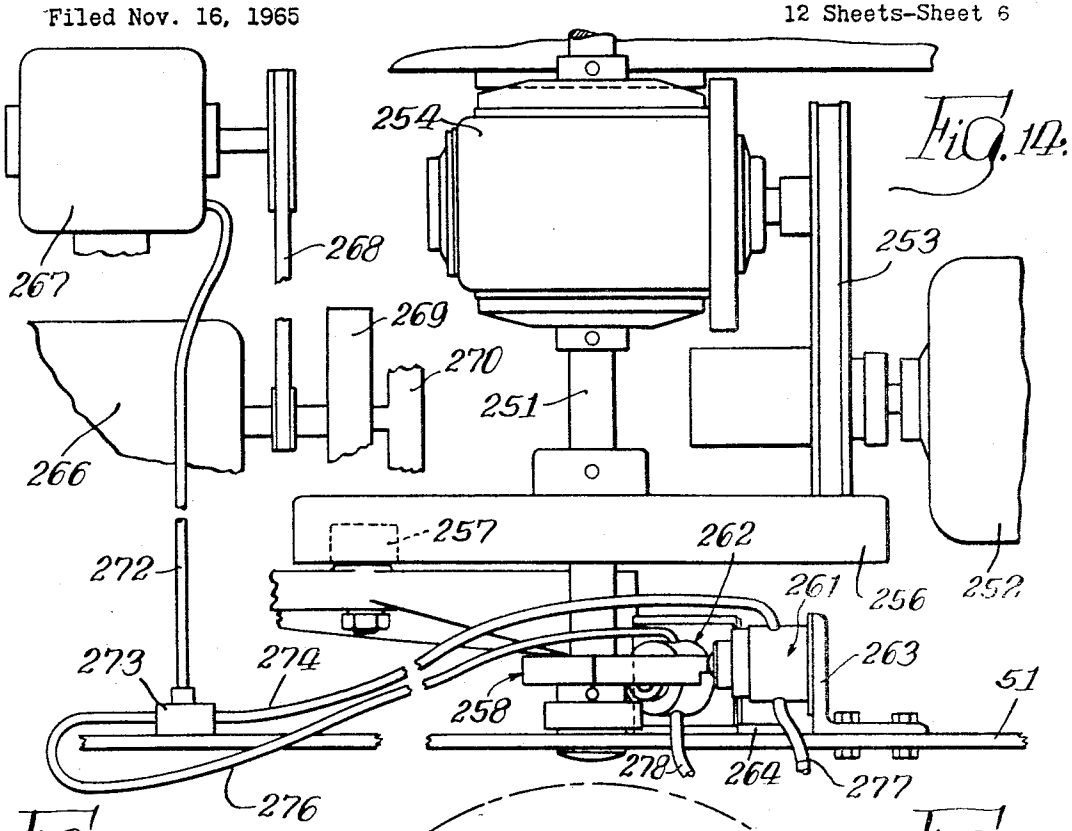


Fig. 14.

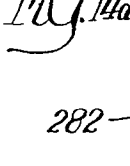


Fig. 14a.




Fig. 13.

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Fig. 16.

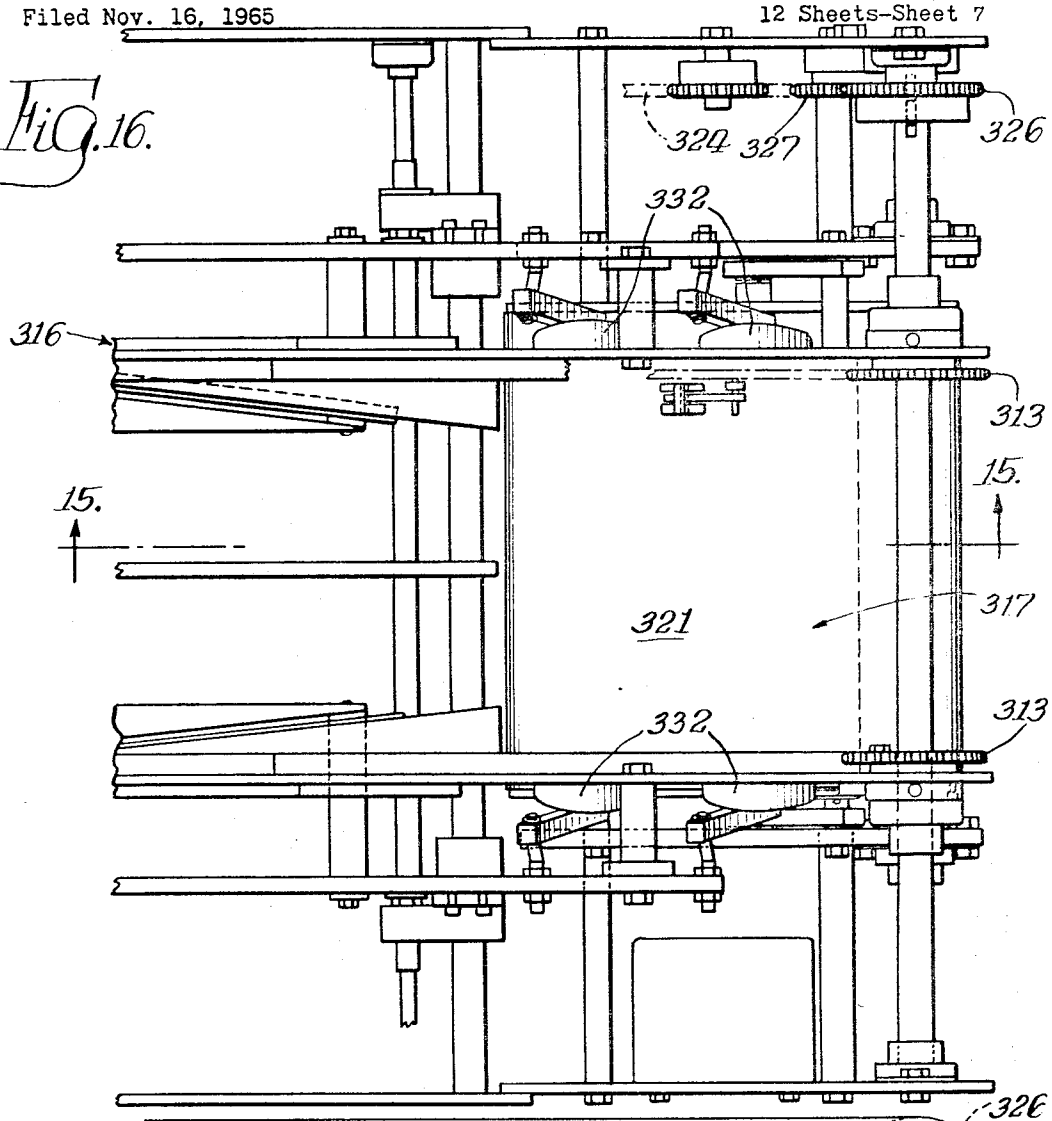


Fig. 15.

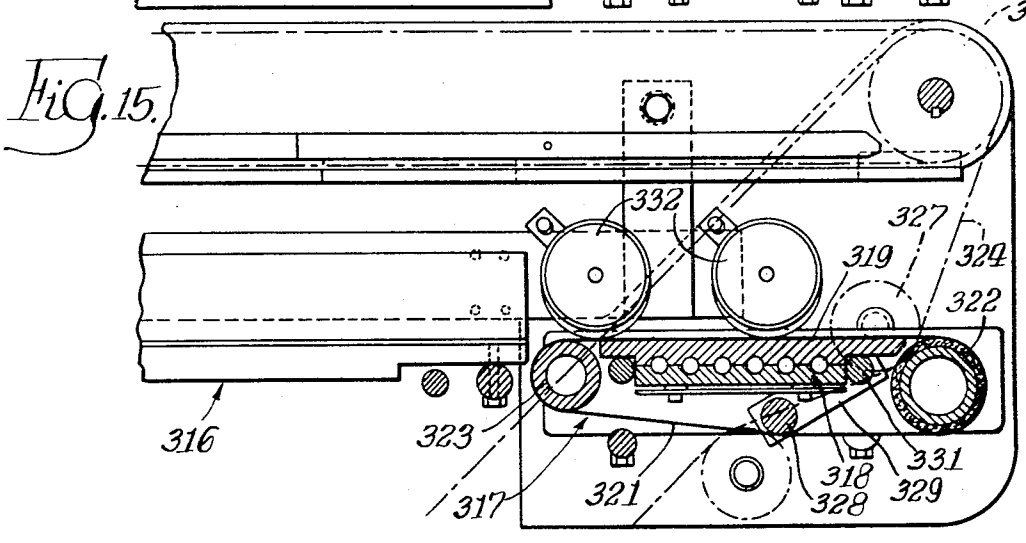

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Fig. 17.

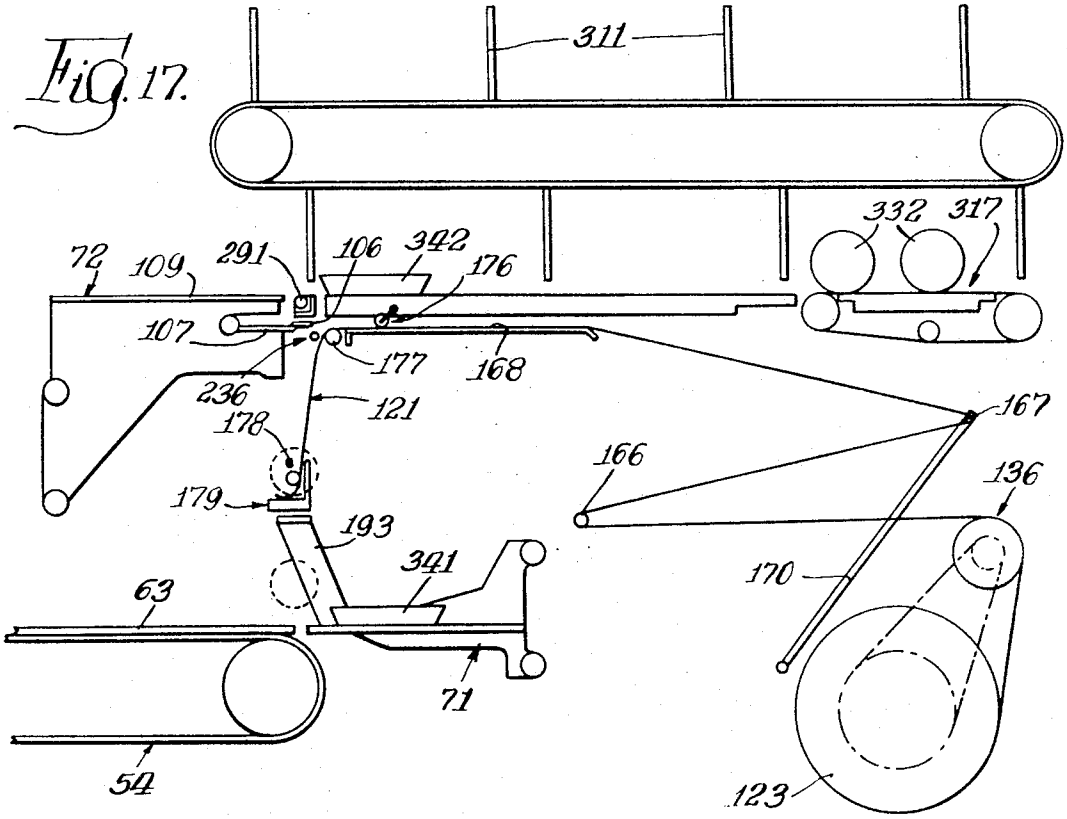


Fig. 18.

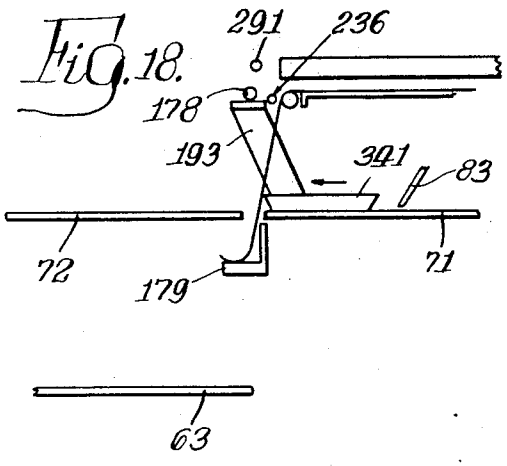


Fig. 19.

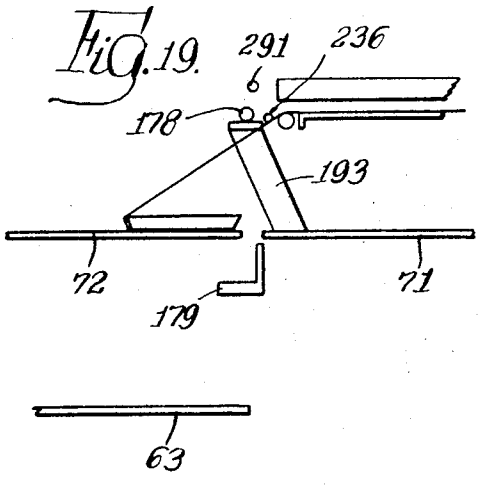

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Fig. 20.

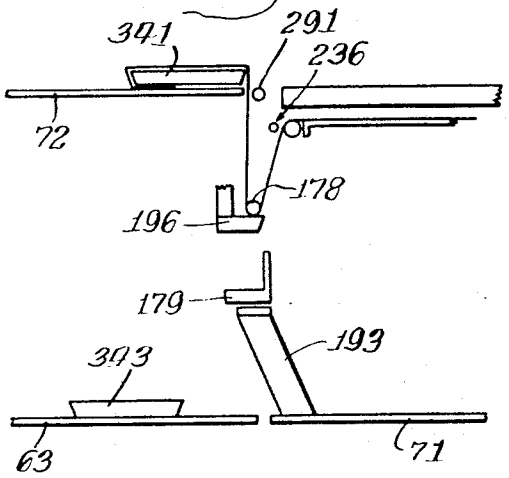


Fig. 21.

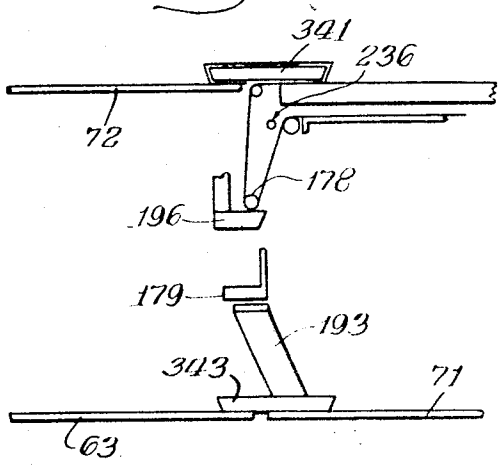


Fig. 22

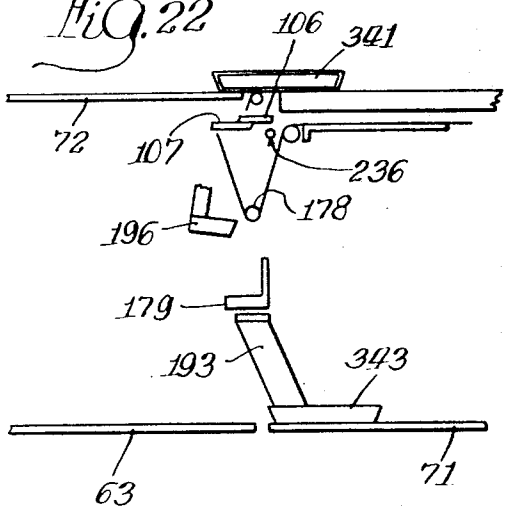


Fig. 23.

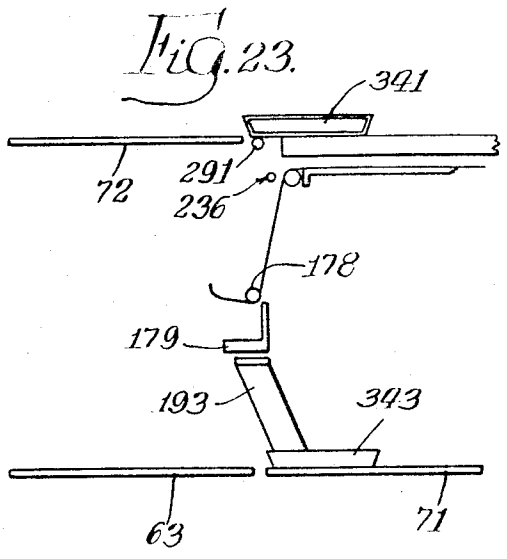

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Fig. 24.

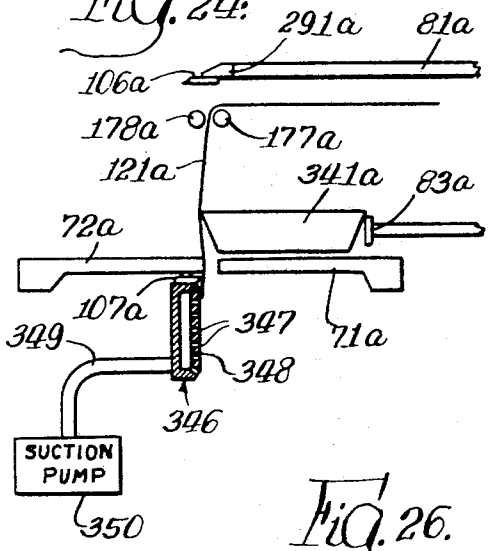


Fig. 25.

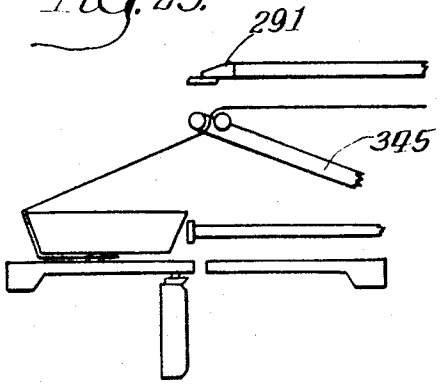


Fig. 26.

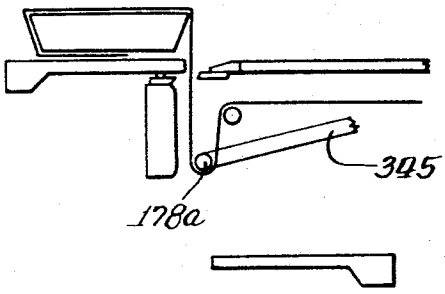


Fig. 27.

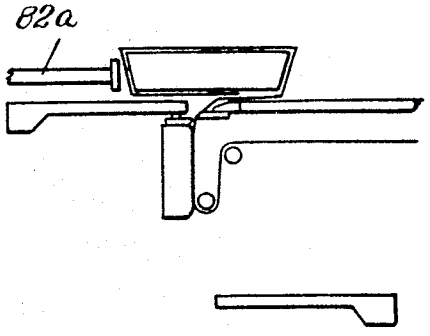


Fig. 28.

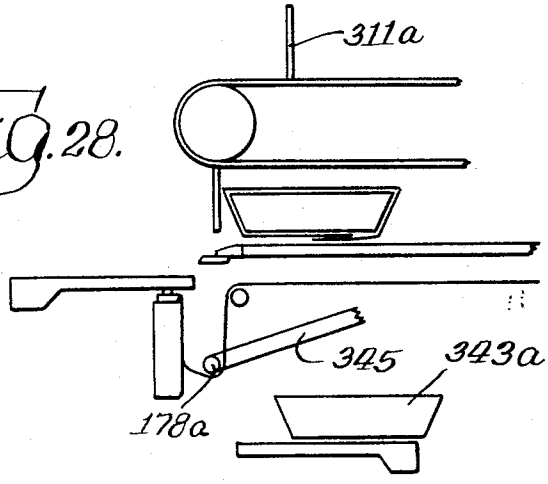

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FIG. 29.

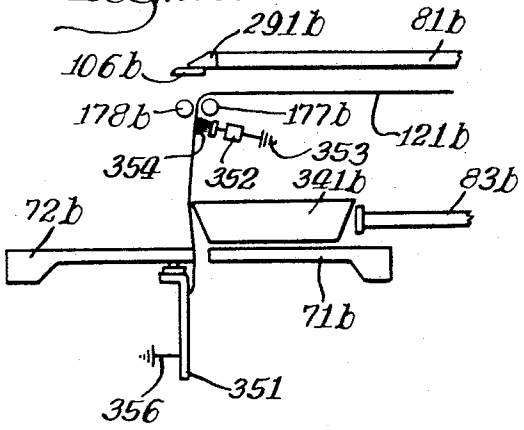



FIG. 30.

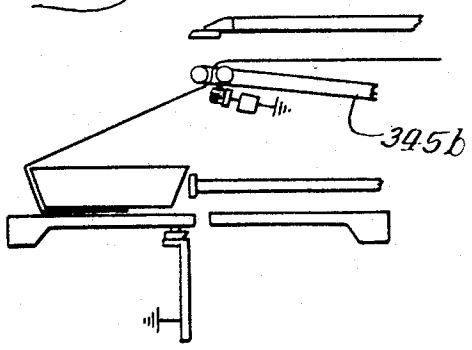



FIG. 31.

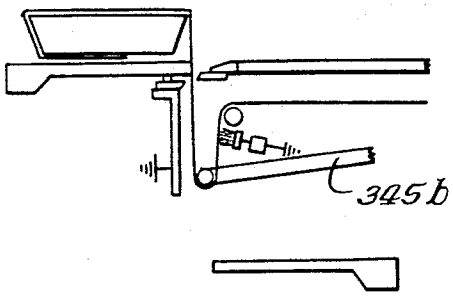



FIG. 32.

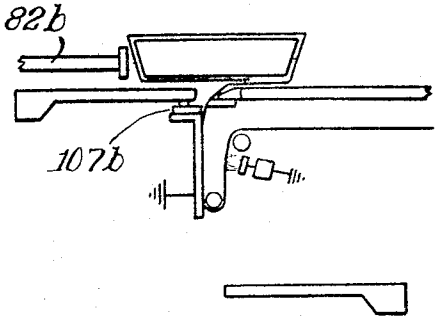
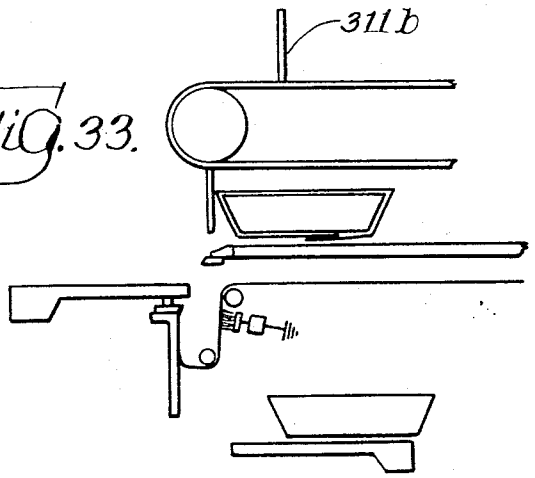



FIG. 33.



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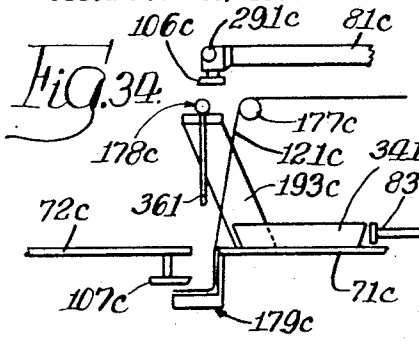


Fig. 34.

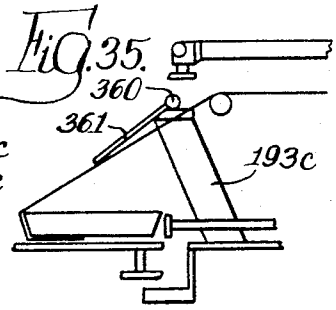


Fig. 35.

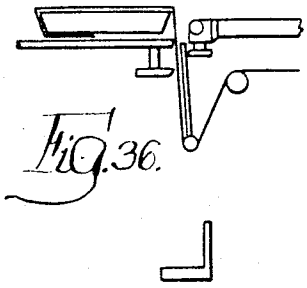

Fig. 36.

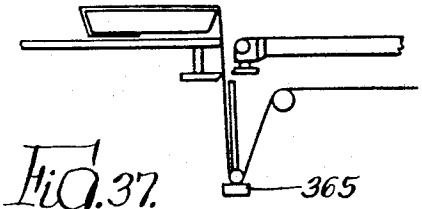


Fig. 37.

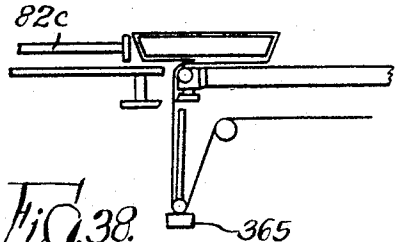


Fig. 38.

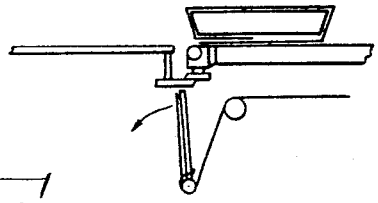

Fig. 39.

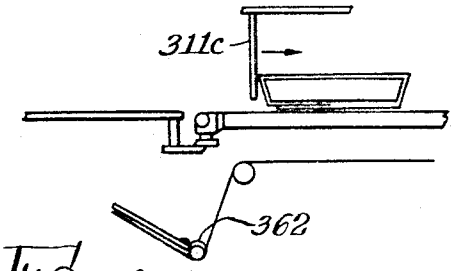


Fig. 40.

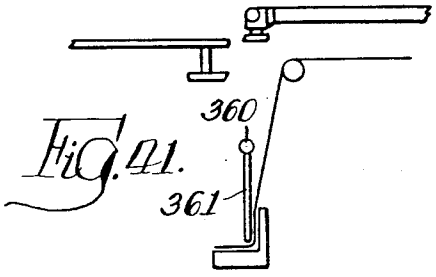


Fig. 41.

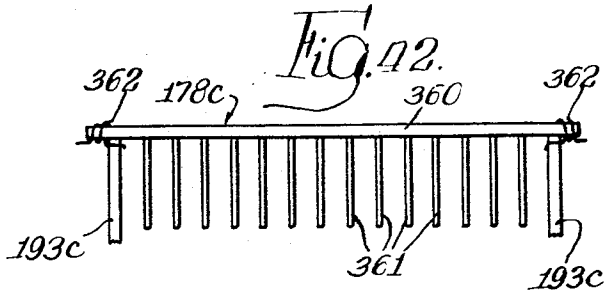


Fig. 42.

United States Patent Office 3,466,849 Patented Sept. 16, 1969



3,466,849

# WRAPPING MACHINE

Edward J. Schaefer and Omar Hansen, Jr., Bluffton, and Robert F. McVicker, Anderson, Ind., assignors to Franklin Electric Co., Inc., Bluffton, Ind., a corporation of Indiana

Filed Nov. 16, 1965, Ser. No. 508,026
Int. Cl. B65b 11/00, 49/00, 7/04
U.S. Cl. 53—210 27 Claims

## ABSTRACT OF THE DISCLOSURE

This disclosure deals with a wrapping machine for wrapping articles such as foodstuffs in a thin plastic film. The wrapping machine includes a film supply and transport mechanism, and a wrapping mechanism for wrapping an article in a section of the film and sealing the film around the article. The film supply and transport mechanism includes means for stripping the film from a supply roll and for automatically supplying film under tension. The wrapping mechanism includes means for preventing portions of the film from clinging to each other, and non-sticking means for heat sealing the film.

There are presently on the market machines for automatically wrapping articles in a thin transparent film. Such a machine is described in the copending patent application of Omar Hansen, Jr., et al. Ser. No. 363,954, filed April 30, 1964, the machine described therein being designed for use primarily as a fresh meat wrapper in a supermarket.

Cellophane has been commonly used as the protective film, and the machine described in the Hansen et al. patent application works very well with such a film. Newer plastic materials, such as polyolefin, have become available for use as the film, which are less expensive than cellophane, and consequently more desirable. Polyolefin is however difficult to handle because it is very thin and, more important, it usually is electrically charged. When charged, this type of film clings to other materials such as metal and, if it becomes folded upon itself, it is very difficult to straighten. One way in which such a film has been used has been to cut the film into sections having the approximate size necessary to wrap a series of articles, and then wrapping the articles in the sections by a combination of manual and automatic operations. Such a system is of course more costly and time consuming than a fully automatic wrapping system wherein the film is taken from a supply roll of the film material and automatically wrapped around the articles and automatically cut to sections having the right dimensions for the articles being wrapped.

Accordingly, it is an object of this invention to provide an automatic wrapping machine, capable of handling thin plastic films, such as polyolefin.

Another object is to provide a machine of the above character, including a novel film feed mechanism for stripping the film from a supply roll and maintaining the film under tension during a wrapping cycle.

A further object is to provide a machine of the above character, including novel means for controlling the free end portion of the film after a section of film has been girdle wrapped around an article and severed.

A still further object is to provide a machine of the above character, including novel means for heat sealing the section of film which has been wrapped around the article.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying figures of the drawings, in which:



FIG. 1 is a side elevational view of a wrapping machine embodying the invention with some parts partially broken away;

FIG. 2 is an enlarged fragmentary view of a portion of the machine;

FIG. 3 is an end elevational view of the structure shown in FIG. 2;

FIG. 4 is a further enlarged sectional view taken on the line **4—4** of FIG. 3;

FIG. 5 is an enlarged fragmentary view of another portion of the machine shown in FIG. 1;

FIG. 6 is a further enlarged fragmentary view of a portion of the structure shown in FIG. 5;

FIG. 7 is a fragmentary end elevational view of a portion of the structure shown in FIG. 6;

FIG. 8 is a fragmentary sectional view of a portion of the structure shown in FIGS. 6 and 7;

FIG. 9 is an enlarged fragmentary view of another portion of the machine shown in FIG. 1;

FIG. 10 is a further enlarged fragmentary sectional view taken on the line **10—10** of FIG. 9;

FIG. 11 is a further enlarged fragmentary sectional view taken on the line **11—11** of FIG. 9;

FIG. 12 is a sectional view taken on the line **12—12** of FIG. 11;

FIG. 13 is an enlarged fragmentary view of another portion of the machine shown in FIG. 1;

FIG. 14 is a plan view of the structure shown in FIG. 13;

FIG. 14*a* is a fragmentary view of a portion of the structure shown in FIGS. 13 and 14;

FIG. 15 is a sectional view taken on the line **15—15** of FIG. 16;

FIG. 16 is an enlarged fragmentary view of another portion of the machine shown in FIG. 1;

FIGS. 17 to 23 are schematic illustrations showing the operation of the machine of FIG. 1;

FIGS. 24 to 28 are schematic illustrations showing an alternative form of a portion of the machine;

FIGS. 29 to 33 are schematic illustrations generally similar to FIGS. 24 to 28 but showing another alternative form of the portion of the machine; and

FIGS. 34 to 42 are schematic illustrations generally similar to FIGS. 24 to 28, FIGS. 29 to 33, but showing still another alternative form of the portion of the machine.

In general, a wrapping machine embodying the invention is generally similar to the wrapping machines described in the above-mentioned copending patent application Serial No. 363,954, and copending patent application Serial No. 219,482, filed August 27, 1962 (now Patent 3,248,848) in the name of Carl Littlefield. A machine of this character comprises a wrapping mechanism, an input mechanism for conveying articles to be wrapped to the wrapping mechanism, and a film supply and transport mechanism for feeding film into the wrapping mechanism, the latter mechanism wrapping the article in a section of the film and sealing the section of film around the article.

The film supply and transport mechanism comprises means for supporting a supply roll of the film, means for stripping film from the supply roll, means for transporting the film to the wrapping mechanism, and means providing a reserve supply of film under tension between the film stripper and the wrapping mechanism. As an article is being wrapped by the wrapping mechanism, film is drawn from the reserve supply, thereby gradually depleting it. When the reserve supply has been depleted to a predetermined length of film, a drive motor connected to the sup-

ply roll and to the film stripper is automatically energized to feed film from the supply roll into the reserve supply to a sufficient extent to replenish the reserve supply. The drive motor is later automatically turned off when the reserve has been replenished, and remains off until the reserve supply has again been depleted. The film in the reserve supply is maintained under tension, the means for maintaining tension also serving to switch the drive motor on and off.

The film supply and transport mechanism further includes means for vertically suspending a length of film adjacent the wrapping mechanism, the latter mechanism being operable to receive an article from the article input mechanism and positioning the article adjacent the length of film and above the lower or free end of the film. The article is then moved horizontally in the forward direction against the film, causing the article to slide over a portion of the film and rest on the free end of the film. The article, and the portion of the film under it, are then moved upwardly, which movement causes the film to be folded over the top of the article and downwardly on the rearward side of the article due to the combination of the upward movement of the article and a dancer roll which pulls the film tightly over the top of the article and downwardly at its rearward side. The article is then moved horizontally in the rearward direction, causing the film at the rearward side of the article to be drawn underneath the article and to overlap its free end. Movement of the article in the rearward direction is halted momentarily while the overlapped portions of the film are over a tack sealer, and after the tack sealing operation has been completed, the section of film around the article is cut off or severed from the supply. In a preferred form of the invention, the dancer roll and a blow tube are then operable to prevent the free end portion of the film from falling or folding back on itself, or from clinging to adjacent portions of the mechanism, and to cause a new length of film to be vertically suspended in preparation for a subsequent wrapping cycle or operation.

The film tends to stick to hot surfaces, and to prevent the film from sticking to the tack sealer, the portion of the sealer contacting the article is made movable with the article. After the overlapped portions of the section of film have been tack sealed and the film cut, the article is moved through an end folding mechanism which folds the ends of the film underneath the article and moves the article to a main sealer. Again, the film is prevented from sticking to the main sealer by making the portion of the main sealer contacting the article movable with the article. After the article has passed the main sealer, it arrives at an output station which may have any desired form.

In greater detail, the wrapping machine comprises a frame **50** (FIG. 1) including two laterally spaced plate members **51** and **52** which are secured together by suitable braces and are mounted on wheels **53** for movement on the floor. Mounted on the frame between the plate members **51** and **52** are an article input mechanism **54**, a wrapping mechanism **56**. and a film supply and transport mechanism **57**.

The article input mechanism **54** is shown as being in the form of a chain conveyor and includes two pairs of laterally spaced sprockets **58** and **59** and two laterally spaced chains **61** which mesh with the sprockets **58** and **59**. Attached between the two chains **61** are a series of runners or pushers **62** which push articles placed between the chains **61** from left to right, or in the rearward direction, as the chains **61** are rotated in the clockwise direction. An article to be wrapped is placed on a horizontal plate **63** between a pair of laterally spaced, longitudinally extending guides **64**, and between adjacent pushers **62**, and one of the pushers **62** engages the article and pushes it along the upper surface of the plate **63** in the rearward direction into the wrapping mechanism **56**. A drive mechanism is connected to rotate the sprockets **58** and **59**, and the chains **61** and the pusher **62** which may be of the character described in the above-mentioned patent applications or any conventional drive. For example, the sprockets **58** and **59** may be connected to laterally extending shafts **66** which are rotatably mounted on the frame **50** between the plates **51** and **52**, and connected by a suitable chain and sprocket arrangement to a main drive motor (not shown in FIG. 1) also mounted between the two plate-like members **51** and **52** generally below the input mechanism **54**. It is preferred that the main drive motor for the input mechanism **54** also be connected to operate the wrapping mechanism **56** so that the rate of rotation of the chains **61** and the positions of the pushers **62** will always have a predetermined relation with the rate of operation and the positions of the parts of the wrapping mechanism **56**, and consequently the two rates may be adjusted simultaneously.

The wrapping mechanism **56** comprises a bottom elevator **71** and a top elevator **72** which are supported by two pairs of arms or bars **73** and **74**, one bar of each pair being shown in FIGS. 1 and 5. One bar of each pair is pivotally connected to one side of each of the elevators **71** and **72**, and at substantially their centers the bars **73** and **74** are also pivotally connected to the frame of the machine as by pins **76** (FIG. 1). At least one, and preferably two, vertically extending links **77** are provided, which extend downwardly from the lower bars **73** and are connected to be moved substantially vertically in a reciprocating motion by a drive mechanism, which as previously stated is preferably the same drive mechanism as that provided for the input mechanism **54**. A suitable drive for the elevators **71** and **72** and the bars **73** and **74** is described in the above-mentioned patent applications, and comprises a cam which is connected to be rotated by a drive motor, and cam follower which is connected by suitable means to the link **77**, the construction of the cam and the linkage being such that the link **77** is moved periodically up and down in a reciprocating motion.

Movement of the link **77** causes the two elevators **71** and **72** to swing between horizontally aligned, intermediate positions shown in dashed lines in FIG. 1, and vertically displaced positions shown in full lines in FIGS. 1 and 5. The elevators **71** and **72** have substantially flat plates **78** and **79**, respectively, which form article supporting surfaces and which are always horizontal because the bars **73** and **74** form parallel arms. When the elevators **71** and **72** are at the intermediate position, the plates **78** and **79** are at substantially the same level, as shown in dashed lines in FIG. 1. When the elevators **71** and **72** are at the vertically displaced positions, the upper surface of the plate **78** is substantially at the level of the upper surface of the plate **63** of the input mechanism **54**, and the upper surface of the plate **79** of the elevator **72** is substantially at the level of a plate **81** (see FIG. 1) of an end folding and sealing apparatus **316** of the wrapping mechanism **56**.

The wrapping mechanism **56** further includes plunger means for moving an article being wrapped from the bottom elevator **71** to the top elevator **72** when the two elevators are at the intermediate position, and also for moving the article from the top elevator **72** to the plate **81** when the two elevators are in the vertically displaced positions. As described in the previously mentioned Hansen et al. patent application, the plunger means comprises a top plunger **82** and a bottom plunger **83**. The top plunger **82** is fastened to a slider **84** which is movable longitudinally of the machine on a suitable guide means **86**, while the bottom plunger is mounted on another slider **87** which is also mounted for longitudinal movement on the machine on another guide means **88**. A link **89** extends between and is connected to the two sliders **84** and **87**, and a suitable cam actuated mechanism, described in the above-mentioned Hansen et al. patent application, is provided for periodically moving the sliders **84** and **87**, and the plungers **82** and **83** attached thereto, longitudinally of the machine in synchronism to move the articles as previously described. The mechanism for operating the

plungers 82 and 83 is constructed such that the movement of the plungers is synchronized with the movement of the two elevators 71 and 72. When the two elevators are at the intermediate position, the two plungers 82 and 83 move toward the left, or forwardly, as seen in FIGS. 1 and 5, the plunger 83 moving an article from the bottom elevator 71 to the top elevator 72, and when the two elevators are in the vertically displaced positions, the two plungers 83 and 82 move toward the right, or rearwardly, the plunger 82 moving an article from the top elevator to the plate 81.

The bottom plunger is preferably in the form of a rake, having a plurality of downwardly extending teeth which sweep across the upper surface of the plate 78 of the bottom elevator 71 and engage the rearward side of an article being wrapped when the plunger 83 is moved forwardly, in order to move an article from the bottom elevator to the top elevator. The top plunger 82 may be a simple rod-like member which angles downwardly and rearwardly as shown in FIG. 1, the lower end of the plunger 82 being at substantially the lateral center of the plate 79 of the top elevator 72. The top elevator 72 is preferably provided with a floating or longitudinally movable receiver bar 91 which is mounted such that it is capable of being moved longitudinally of the machine at substantially the lateral center of the plate 79. As described in the Hansen et al. patent application, the receiver bar 91 comprises a generally rectangular block 90 (FIG. 5) which is connected to the plate 79 by a nut and bolt arrangement 95 in a manner such that the amount of sliding friction between the block 90 and plate 79 may be adjusted. An angle shaped bracket 92 is preferably secured to the rearward side of the block, one arm of the bracket extending generally vertically and the other arm of the bracket being positioned to extend under the bottom of an article being wrapped adjacent its forward edge. As will be described hereinafter, the film being wrapped about the article is caught between the bracket 92 and the article. When the article being wrapped is pushed by the bottom plunger 83 from the bottom elevator 71 to the top elevator 72, the forward side of the article engages the bracket 92 and pushes the bracket and the block forwardly of the machine and, subsequently, when the article is pushed by the top plunger 82 rearwardly of the machine, the plunger 82 engages the block 91 and pushes it and the article toward the right, or rearwardly until the article is deposited on the plate 81.

As described in the previously referred to Hansen et al. patent application, mounted on the upper surface of the plate 79 of the top elevator 72 are a pair of laterally spaced end folders 96, which are laterally adjustable, relative to the plate 79 depending upon the width of the article being wrapped. The folders 96 are shaped to engage the film at the lateral ends of the article and fold the film at the ends of the article as the article is being pushed from the bottom elevator 71 to the top elevator 72.

Further, as the top elevator 72 is being moved upwardly during wrapping cycle, the film is stretched tightly across the upper surface of the article so that there is a tendency for the taut film to pull the article rearwardly off of the plate 79 of the top elevator. To prevent this, a rake-like bracket 97 (FIG. 5) is provided, having a plurality fo generally vertically extending stop fingers 98 (FIG. 5) which are located adjacent the rearward edge of the plate 79 of the top elevator. The bracket 97 is mounted underneath the plate 79, for pivotal movement relative to the top elevator, by means of a shaft 99, and a tension spring 101 is connected to the bracket 97 at the end of the bracket which is opposite from the fingers 98, and to the top elevator 72. The spring 101 urges the fingers 98 in the counterclockwise direction as seen in FIG. 5, or upwardly. Slots are formed in the rearward edge of the plate 79 and the fingers 98 normally extend through these slots.

To retract the fingers 98 below the upper surface of the plate 79 when either an article is being moved on to the top elevator 72 or being moved off of the top elevator 72, a bottom actuator 102 and a top actuator 103 are provided. The bottom actuator 102 is mounted on the plate 63 of the input mechanism 54 and extends upwardly therefrom to a position where it engages the bracket 97 forwardly of the shaft 99 and thereby pivots the bracket 97 in the clockwise direction to retract the fingers 98 when the top elevator 72 is at the intermediate position. The height of the bottom actuator 102 is adjusted such that the bracket 97 will be pivoted to lower the fingers 98 below the upper level of the plate 79. When the top elevator 72 is moved toward its upper position, the bracket 97 moves out of engagement with the bottom actuator 102 and the fingers 98 move upwardly and hold the package on the plate 79. When the elevator 72 reaches the upper position, the top actuator 103 engages the bracket 97 forwardly of the shaft 99 and pivots the bracket 97 in the clockwise direction as seen in FIG. 5 and again causes the fingers 98 to be retracted below the upper level of the plate 79, thereby permitting the article to be pushed off the top elevator 72 and on to the plate 81. Of course, as soon as the top elevator 72 again moves downwardly, the bracket 97 moves out of engagement with the top actuator 103 and the fingers 98 again move upwardly above the upper surface of the plate 79.

The wrapping mechanism 56 further includes scissor-like means for severing the film after it has been wrapped around an article and tack sealed. The severing means comprises a horizontal, laterally extending stationary blade 106 (FIG. 5) which is fixed to the frame of the machine just below and forwardly of the forward edge of the plate 81. The severing means further includes a pair of movable blades 107 carried by the top elevator 72 on the underside thereof and at the rearward edge. The movable blades 107 are carried by brackets 108 and extend laterally of the machine in end-to-end relation. As described in the copending Hansen et al. application, the two blades form a V with the apex of the V being toward the left and at substantially the lateral center of the top elevator 72. From the apex, each of the blades 107 extends laterally of the machine and rearwardly, and each of the blades also slopes downwardly a slight amount from its apex. When the top elevator 72 moves to its upper position, the outer lateral ends of the blades 107 contact the underside of the stationary blade 106, and when the brackets 108 are moved rearwardly, the downward and rearward slant of each of the blades 107 causes the blades to be in point-to-point contact only with the stationary blade 106. This produces a scissors-like action which prevents tearing or pulling of the film while it is being severed. The brackets 108 are mounted for pivotal movement on the top elevator 72 by a laterally extending shaft 109 which is fastened to the top elevator 72, and a tension spring 111 connected between the forward end of the bracket 108 and the top elevator 72 urges the bracket 108 and the blades 107 upwardly, or in the counterclockwise direction as seen in FIG. 5. The shaft 109 is also mounted for longitudinal movement relative to the top elevator 72, and as described in the above-mentioned copending patent applications, after the top elevator 72 has moved to its upper position, an article on the top elevator has been pushed rearwardly by the plunger 82, and the film has been tack sealed, the bracket 108 and the shaft 109 and the blades 107 are moved rearwardly to sever the section of film around the article. The mechanism for moving the rod or shaft 109, and consequently the bracket 108 and the blades 107, longitudinally of the machine comprises a suitable cam 112 and cam follower 113 mechanism (FIG. 5) which is preferably also actuated by the main drive motor in synchronism with the movements of the elevators and the plungers.

The film, indicated by the reference numeral **121** in FIG. 1, for wrapping an article, is delivered to the wrapping mechanism **56** by the film feed and transport mechanism **57** which comprises an arbor **122** (FIGS. 1 to 3) for supporting a supply roll **123** of film, the arbor **122** being connected to be driven by a motor-gear box unit **124**. As described in detail in the copending Hansen et al. patent application, the arbor **122** comprises a cylindrical tube **126**, the outer diameter of which is slightly less than the inner diameter of the supply roll **123** so that the roll **123** may easily be slipped over the arbor **122**. The tube **126** is connected to the motor-gear box unit **124** by a drive shaft (not shown) which extends through a support tube **127**, the latter tube extending through a hole formed in a mounting plate **128**. The plate **128** is secured to the frame of the machine, and the motor-gear box unit **124** is secured to one side of the plate **128** while the arbor **122** is rotatably fastened to the support tube **127** and extends laterally of the machine from the other side of the plate **128**. The drive shaft extends through the support tube **127** and into the tube **126** and has a driving connection therewith. A series of slots **131** are formed through the wall of the tube **126** and a plurality of radially movable fingers **132** extend through the slots **131** and are adapted to grip the inner periphery of the supply roll **123** when the roll is positioned on the tube **126** and the fingers **132** are radially extended. The fingers **132** are connected for movement radially inward or outward to a mechanism having a manually operated actuating knob **133** at the free end of the tube **126**.

With a film of the character herein contemplated, the film tends to cling to itself on the supply roll **123**. To avoid this difficulty a stripper roller **136** is provided, the stripper roller pulling the film off the supply roll **123**. To this end, the stripper roller **136** is mounted on the plate **128** and connected to be driven by the motor-gear box unit **124** (FIGS. 1 to 4). With reference to FIG. 4, the stripper rollers **136** comprises a shaft **137** having one end extending through a hole **138** formed in the mounting plate **128**. The diameter of this end of the shaft **137** is reduced to form a shoulder **139** and the reduced diameter end portion of the shaft **137** is externally threaded to receive a nut **141** and a washer **142**. To rigidly secure the shaft **137** to the plate **128**, this end of the shaft **137** is placed in the hole **138** with the shoulder **139** abutting the margin of the hole **138**, at one side of the plate **128**. The washer **142** is then positioned on the shaft, and the nut **141** is threaded on the end of the shaft to clamp the washer **142** against the other side of the plate **128**.

Positioned coaxially over the shaft **137** is a cylindrical tube **143** which has one end secured to an inner end plate **144** adjacent the mounting plate **128**, and its other end secured to an outer end plate **146**, the two plates **144** and **146** having axial holes **147** formed therethrough which receive the shaft **137**. Bearings **148** are preferably provided between the end plates **144** and **146** and the shaft **137**.

To rotate the tube **143** relative to the shaft **137**, a sprocket **149** is rotatably positioned around the shaft **137** between the end plate **144** and the mounting plate **128** and is connected to the plate **144** by a slip clutch arrangement. The clutch comprises a disc **151** secured to the outer periphery of a hub portion of the sprocket **149** and a disc **152** of friction or brake material such as rubber positioned between the disc **151** and the end plate **144**. The adjacent surfaces of the disc **151** and the plate **144** are substantially flat and parallel to each other, and the friction disc **152** transmits rotative motion from the disc **151** to the end plate **144**.

To prevent the disc **151** and the sprocket **149** from moving axially away from the tube **143**, a thrust bearing **153** is mounted on the shaft **137** between the sprocket **149** and the mounting plate **128**. One race of the thrust bearing **153** abuts the mounting plate **128** while the other race of the thrust bearing **153** abuts the sprocket **149**. Thus, axial pressure tending to move the tube **143** toward the mounting plate **128**, causes an axial thrust to be exerted on the end plate **144**, the friction disc **152**, the disc **151**, the sprocket **149**, the thust bearing **153** and the stationary mounting plate **128**. The thrust bearing **153** thus permits the sprocket **149** and the tube **143** to rotate freely relative to the mounting plate **128** in spite of such an axially directed thrust.

It will be apparent that the amount of such an axially directed force determines the extent of the frictional coupling between the disc **151** and the end plate **144**, and consequently the amount of slip between these two members when the sprocket is being driven. The axially directed thrust may be adjusted by means of a hand wheel or knob **154** threaded on the free end of the shaft **137**. A compression spring **156** is positioned between the knob **154** and the outer end plate **146**, and when the knob **154** is threaded on the shaft **137**, the spring **156** is compressed and urges the end plate **146** and the tube **143** toward the right, and thereby increases the frictional coupling between the disc **151** and the plate **144**. If it is desired to decrease the amount of frictional coupling between the disc **151** and the end plate **144**, the knob **154** is turned to move it to the left, which reduces the compressive force on the spring **156**.

The knob **154** may be secured to the shaft **137** at an axially adjusted position by a set screw **158** which is threaded into a radially extending hole **159** formed in the knob **154**. A nylon plug **161** is perferably positioned between the set screw **158** and engages the threads of the shafts **137**. Since the spring **156** is stationary relative to the shaft **137**, while the plate **146** rotates relative to the shaft **137**, a washer **162** is preferably positioned between the plate **146** and the spring **156**.

The stripper roller **136** is driven by the motor-gear box unit **124**. A chain **163** is trained around the sprocket **149** and another sprocket **164** which is secured to the rotating tube **126** of the arbor **122**. Thus, when the motor-gear box unit **124** is energized, the sprocket **164** and the film supply roll mounted on the arbor **122** are rotated in the counterclockwise direction as seen in FIG. 1, and rotation of the sprocket **164** drives the chain **163** and the sprocket **149** also in the counterclockwise direction. Further, the tooth ratio of the sprockets and the diameter of the tube **143** are such that, if there were a direct drive between the disc **151** and the plate **144**, the surface speed of the tube **143** would be slightly greater than the surface speed of the largest size film supply roll normally used. During the operation of the film feed and transport mechanism **57**, the film supply roll **23** is slipped over the arbor **122** and secured thereto by turning the knob **133**. The supply roll is mounted with its free end extending upwardly from the rearward side of the roll, and the film is threaded from the roll **23** upwardly and over the stripper roll **136** from the rearward side thereof, then forwardly of the machine under and around the forward side of a stationary laterally extending roller **166** which is secured to the frame **50**, over the top of the roller **166** and rearwardly of the machine, under and around the rearward side of a tension roller **167** (FIG. 1), over the top of the roller **167**, and then forwardly of the machine and over the upper surface of the plate **168**. As explained in the previously mentioned Hansen et al. application, the tension roller **167** extends laterally of the machine and is rotatably mounted at the ends of two laterally spaced tension arms or levers **170** which are fastened to and rotate with a shaft **169**. The shaft **169** is also rotatably supported by the mounting plate **128**, and one end of the shaft **169** carries a cam (located on the side of the plate **128** which is not shown in FIG. 1). The cam is connected to actuate a switch for controlling the motor-gear box unit **124**. The cam and switch arrangement is such that the unit **124** is turned on when the arms **170** swing in the

counterclockwise direction and reach a first predetermined position, and the unit **124** is turned off when the arms **170** swing in the clockwise direction and reach a second predetermined position. A spring (not shown) urges the arms **170** in the clockwise direction thereby maintaining tension on the film and holding the film against the stripper roller **136**, and the pull of the film during a wrapping cycle urges the arms in the counterclockwise direction. During the operation of the machine, the film **121** is drawn into the wrapping mechanism as each article is being wrapped and the consequent pull on the film **121** swings the tension roller **167** and the arms **170** in the counterclockwise direction as seen in FIG. 1. When the shaft **169** and the arms **170** reach the first predetermined angular position, the cam attached to the end of the shaft **169** closes the control switch for the motor-gear box unit **124**. Upon energization of the unit **124**, the arbor **122** is rotated in the counterclockwise direction as seen in FIGS. 1 and 3. Further, due to the chain and sprocket connection between the arbor **122** and the stripper roller **136**, the stripper roller **136** is also rotated in the counterclockwise direction as seen in FIGS. 1 and 3. As previously stated, the surface speed of the stripper roller tends to be slightly greater than the surface speed of the film supply roll **123** when the roll **123** is fresh and, consequently, has a relatively larger diameter, but the film frictionally engages the surface of the stripper roller **136** and causes the surface speed of the roller **136** to be substantially the same as the film speed. The restraining effect of the film on the stripper roller **136** results in slip of the slip clutch, and the amount of slip increases as the diameter of the supply roll decreases. Further, the amount of tension on the film between the supply roll and the stripper roller may be adjusted by adjusting the tension on the spring **156**, using the knob **154**. Due to the tendency of the stripper roller **136** to turn faster than the supply roll, the former strips or pulls the film from the supply roll **123**. To increase the frictional coupling between the stripper roller **136** and the film **121**, a plurality of bands **171** (FIGS. 2 and 3) of a friction material are fastened to the outer periphery of the tube **143**. Annular grooves **172** are formed in the outer periphery of the tube **143**, which receive the bands **171**.

From the tension roller **167**, the film **121** is threaded over the top of the plate **168** (FIGS. 1, 5 and 6) underneath a one way check mechanism **176** which is mounted on the frame of the machine over the upper surface of the plate **168**. The check mechanism **176** permits movement of the film **121** in the forward direction but pinches the film **121** against the plate **168** when there is a tendency for the film **121** to move rearwardly, as when the film **121** is pulled by the tension roller **167** and the tension arms **170**. At the forward edge of the plate **168** is positioned a laterally extending stationary draper shaft **177**, and the film **121** normally extends downwardly over the forward side of a shaft **177**. When the wrapping machine is idling between packages, the film **121** normally extends downwardly around the forward side of the shaft **177**, past the rearward side of a dancer roller **178**, and between the adjacent edges of the two elevators **71** and **72** when in their intermediate positions. The free end portion of the film **121** is held by a suction baffle plate **179** (FIGS. 5, 6 and 9) which extends laterally of the machine and is secured to the frame as by brackets **181**. The baffle plate **179** comprises a vertically extending back **182** and a horizontal shelf **183** which extends forwardly from the lower edge of the back **182**. The shelf **183** has a hollow interior which forms a suction box (FIG. 5), each end of the shelf **183** being connected by a length of hose **184** (FIG. 9) to means, such as a motor driven fan, for producing a partial vacuum. The top side of the shelf **183** has sets of holes **185** formed therein, and air is drawn into the interior of the hollow shelf **183** through the holes **185**. This suction draws the film **121** to the shelf **183** and holds the free end portion of the film **121** flat against the shelf **183**, thereby preventing curling of the free end of the film **121** and also preventing curling of the vertical edges of the film adjacent its free end.

The dancer roller **178** also extends laterally of the machine and mounted between two pairs of vertically extending guides **191** and **192** (FIGS. 1 and 5), the pair **191** of guides being located at one side of the machine and the pair **192** of guides being located at the other side of the machine. The guides of each pair are longitudinally spaced to form a vertical slot at each side of the machine, and the ends of the dancer roller **178** extend into the slots. The dancer roller **178** is vertically movable within the slots and, during different portions of each wrapping cycle, is supported either by a pair of lifts **193**, a pair of stationary stops **194**, or a pair of movable stops **196**.

As shown in FIG. 5, the two lifts **193** are secured to the bottom elevator **71** and extend upwardly and forwardly from the forward edge of plate **78**. As shown in FIGS. 6 and 7, the lifts **193** are spaced laterally inwardly from the guides **191** and **192**, and the upper ends of the lifts are adapted to engage sleeves **190** of the dancer roller and lift the dancer roller **178** upwardly upon movement of the bottom elevator **71** to the intermediate position. Such upward movement of the dancer roller during each wrapping cycle is desirable because it is then out of the way and permits an article to be transferred from the bottom elevator **71** to the top elevator **72** while the two elevators are at the intermediate position. Resilient bumpers **197** are preferably secured to the upper end surfaces of the lifts **193** to cushion the impact of the lifts **193** with the sleeves **190** when the lifts **193** move upwardly and engage the dancer roller **178**.

One of the stationary stops **194**, which may comprise ring shaped members, is positioned in the slot between the pair of guides **191** and the other of the stops **194** is positioned in the slot between the other pair of guides **192**. The two stops **194** are secured to the guides **191** and **192** as by bolts **198** (FIGS. 6 and 7) at locations such that the dancer roller **178**, while resting on the stationary stops **194**, is spaced a short distance above the shelf **183** of the suction baffle plate **179**, as shown in dashed lines in FIG. 6.

With reference to FIGS. 6 and 7, the movable stops **196** are secured to the lower ends of a pair of vertically extending levers **201**, each of the levers **201** being associated with and positioned on the forward side of one pair of guides **191** and **192**. Each lever **201** is mounted for pivotal movement on a lateral axis by a pair of pins **202** which in turn are mounted on blocks **203** secured to the guides **191** and **192** as by bolts **204**. The stops **196** extend rearwardly of the machine from the lower ends of the levers **201**, through holes **206** formed through the adjacent guides **191** and **192** and into the slots between the guides.

Above the pivotal connection **202** of each of the levers **201**, a compression spring **207** is positioned between the lever **202** and the forwardmost guide of each pair. Grooves **208** are preferably formed in the levers **201** and the adjacent guides and the ends of the springs **207** are seated in the grooves **208** in order to hold the springs **207** in place. The compression springs **207** tend to pivot the levers **201** in the counterclockwise direction as seen in FIG. 6, and thus to urge the stops **196** into the holes **206**. Movement of the stops **196** into the holes **206** beyond a predetermined amount is prevented however by bumpers **209** (FIG. 6) fastened to the forwardmost guides **191** and **192**, which extend forwardly from the guide, the bumpers **209** being adapted to abut the levers **201**.

As shown in FIG. 6, the movable stops **196**, when they have been pivoted fully in the counterclockwise direction, extend into the slots between the pairs of guides **191** and

192, and the rearward side 211 of each of the stops 196 extends into the associated slot and is slanted upwardly and rearwardly from its lower side.

As shown in FIGS. 6, 10 and 11, the dancer roller 178 includes rectangular dancer roller guide blocks 222 and 223 secured to its ends. The horizontal thickness of the outer end portions 222*a* and 223*a* of the blocks is reduced and is slightly less than the width of the slots, and the portions 222*a* and 223*a* are positioned in the slots with the vertical dimension of the portions 222*a* and 223*a* greater than the horizontal thickness. Thus, the dancer roller 179 may be moved vertically between the guides 191 and 192 but the guides and the portions 222*a* and 223*a* prevent turning movement of the dancer roller 178. Further, each of the portions 222*a* and 223*a* is slanted at its upper and forward corner 212 (FIG. 6).

The lowermost position of the dancer roller 178 is determined by the location of the stationary stops 194. Assuming that the roller 178 is initially resting on the stops 194 and the elevators 71 and 72 are at their vertically displaced positions, when the bottom elevator 71 moves upwardly the lifts 193 pick up the dancer roller 178. During such upward movement, the slanted corners 212 at the ends of the dancer roller 178 engage the slanted sides 211 of the two movable stops 196 and cam the stops 196 forwardly. The levers 201 pivot in the clockwise direction as seen in FIG. 6 against the force of the compression springs 207 to permit such forward movement of the stops 196. The dancer roller 178 is moved upwardly past the stops 196 and then the latter return to their normal positions due to the action of the springs 207. The uppermost position of the dancer roller is indicated in dash-dot lines in FIG. 6, and this position exists when the two elevators 71 and 72 are at the intermediate positions. Thus, the dancer roller 178 is moved upwardly and held there while an article is being transferred from the bottom elevator 71 to the top elevator 72. Subsequently, the bottom elevator 71 moves downwardly and permits the dancer roller 178 to drop due to the force of gravity. The extent of the downward movement of the dancer roller 178 is initially limited, however, by the movable stops 196 which engage the bottom sides of the end portions 222*a* and 223*a* of the dancer roller 178 and hold it in the intermediate position shown in full lines in FIG. 7. The dancer roller 178 is held in this intermediate position while the article is being transferred from the top elevator 72 to the plate 81. The mechanism which moves the film severing blades 107 after the film has been tack sealed, also carries a pair of actuators 216 (FIG. 6) which are located to engage the upper ends of the levers 201 and pivot the levers 201 in the clockwise direction as seen in FIG. 6. Thus, after the section of film around the article has been tack sealed, the film is severed and the levers 201 are pivoted to cause the movable stops 196 to swing toward the left as seen in FIG. 6, out of engagement with the ends of the dancer roller 178. The dancer roller again drops downwardly to the stationary stops 194, pushing the end portion of the film downwardly and laying the film on the suction baffle plate 179.

The dancer roller 178, acting in conjunction with a blow tube 236, prevents the end portion of the film from falling rearwardly upon itself after an article has been girdle wrapped and the film has been severed. Just before the film is severed, the film is draped downwardly on the forward side of the draper shaft 177 looped under the dancer roller 178, and upwardly to the rearward edge of the top elevator. The portions of the looped film on the rearward and forward sides of the dancer rolled are relatively close together, and the dancer roller and the blow tube are constructed to blow air into the space between the looped portions of the film. This air raises the pressure in this space slightly and when the film is severed, the pressure acts on the two portions of the film to hold them apart.

With reference to FIGS. 9 to 12, the dancer roller 178 comprises a tube 221, preferably made of a material such as stainless steel, and the blocks 222 and 223 secured to the ends thereof. The block 222 is secured to one end of the tube 221 as by a roll pin 224 and the other block 223 is secured to the opposite end of the tube 221 as by a set screw 226. The block 222 closes the associated end of the tube 221 and the other block 223 has a radially extending hole 227 formed thereon, which receives a relatively small tube 228 (FIG. 11). The interior of the block 223 is hollowed out to receive the associated end of the tube 221, and the tube 228 is in communication with a hollow interior of the block 223 and the interior of the tube 221.

To help to prevent the film from clinging to the dancer roller, a plurality of axially spaced rollers 231, which may be made of a material such as hard plastic, are rotatably positioned on the tube 221. The rollers 231 are held in axially spaced relation as by a plurality of C-shaped members 232 which are positioned in annular grooves 230 formed in the other periphery of the tube 221. The members 232 are generally square in cross section, and the grooves 230 are square shaped to receive the members 232. A member 232 is located at each end of each of the rollers 231, the members 232 being engageable with the ends of the rollers 231 and thereby preventing axial movement of the rollers 231 relative to the tube 221, but permitting rotative movement of the rollers relative to the tube.

In the spaces between adjacent rollers 231, a plurality of radially extending holes 233 (FIGS. 11 and 12) are formed through the wall of the tube 221, extending from the interior of the tube to the outer surface thereof, a set of three holes 233 being shown in each space, and the holes 233 are located relative to the rectangular end portions 222*a* and 223*a* of the blocks 222 and 223 such that one hole of each set opens substantially downwardly, another hole of each set opens downwardly and forwardly of the machine, and the third hole of each set opens upwardly and forwardly of the machine. As will be explained hereinafter, the tube 228 is connected to a flexible air hose 277 (FIG. 6) which leads to an air pump, and, during a portion of each wrapping cycle, air is forced into the tube 221 and out through the holes 233. The air jets passing through the holes 233 are directed to blow the severed end portion of the film forwardly and downwardly and thereby prevent this portion from falling rearwardly and contacting the portion of the film extending downwardly from the draper shaft 177.

To further ensure that the film will not fall rearwardly of the machine after it has been severed, a laterally extending blow tube 236 (FIGS. 6, 7, 9 and 10) is provided to blow the film end forwardly. The blow tube 236 is located just forwardly of the stationary draper shaft 177 (FIG. 6) and is supported by a pair of brackets 237 which are secured to the frame of the machine and engage the ends of the blow tube 236. With reference to FIG. 10, the blow tube 236 is closed at one end by a plug 238 and is open at the opposite end, the open end being adjacent the tube 228 of the dancer roller 178. Two sets 239 and 241 of holes are formed along the length of the blow tube 236 at axially spaced locations, the set 239 of the holes facing substantially forwardly of the machine and the other set 241 of the holes facing substantially downwardly. Again as will be described in more detail hereinafter, a flexible air hose 278 (see FIG. 7) is fastened to the open end of the tube 236 and leads to an air blower or pump, and during a portion of each wrapping cycle, air is forced into the tube 236 and out of the holes 239 and 241, and into the space between the adjacent portions of the looped film, and thereby prevent the free, severed end portion of the film from falling rearwardly of the machine.

The apparatus for supplying air under pressure to the dancer roller 178 and the blow tube 236 at the proper portions of each cycle is shown in FIGS. 13, 14 and 14*a*.

The apparatus comprises a main drive shaft **251** which extends laterally of the machine and is mounted for rotation on the frame. A main drive motor **252** is connected through a belt **253** and a gear box **254** to rotate the main shaft **251**. Connected to the shaft **251** are suitable cams and cam followers, such as the cam **256** and the follower **257**, moving the elevators **71** and **72**, the cutting blades **106** and various other mechanisms of the machine.

In addition, a cam **258** is clamped to the shaft **251** by means of bolts **259**, and the cam **258** has two edge cam surfaces which are positioned to engage and actuate two air valves **261** and **262**. The valves **261** and **262** are respectively mounted on the plate **51** by means of brackets **263** and **264**. The valve **261** is connected to control the supply of air to the dancer roller **178** and the valve **262** is connected to control the supply of air to the blow tube **236**.

Also mounted on the frame of the machine are an electric motor **266** and an air pump **267**, the motor **266** being connected by a belt **268** to drive the air pump **267**. The drive shaft of the motor may also be connected to drive a device **269** which produces a partial vacuum for the suction baffle plate **179**. The device **269** may be connected by suitable conduits **270** and the hose **184** (see FIG. 9) to operate the suction baffle plate **179**.

Air from the pump **267** is delivered by a flexible air tube or hose **272** to a T-fitting **273** mounted on the plate **51**, for example. The T-fitting **273** receives air from the tube **272** and directs it to two other air tubes **274** and **276** which are also connected to the inlets of the valves **261** and **262**, respectively. The outlets of the two valves **261** and **262** are respectively connected to the two tubes or hose **277** and **278** which supply air to the dancer roller **178** and to the blow tube **236**.

As shown in FIGS. 13 and 14*a*, the cam **258** has the two previously referred to cam surfaces **281** and **282** formed on its outer periphery. The cam surface **282** is adapted to engage an actuating button **283** for the valve **261**, which is connected to control the supply of air to the dancer roller **178**, and the cam surface **282** is adapted to engage an actuating button for the valve **262**, which is connected to control the supply of air to the blow tube **236**. The cam surface **281** is constructed to engage the button **283**, and thereby open the valve **261**, during approximately a 65° arc in each circle of revolution of the drive shaft **251** and the cam **258**, and the other cam surface **282** is constructed to engage the button **284**, and thereby open the valve **262**, during approximately a 30° arc in each circle of revolution. Further, the valves **261** and **262** are positioned and the cam surfaces **281** and **282** are constructed such that the valve **262** for the blow tube is turned on first by the cam surface **282** and remains on for approximately a 30° arc of the revolution of the cam **252**. Each complete revolution of the drive shaft **251**, and consequently the cam **258**, corresponds to one wrapping cycle of the machine. At substantially the same time that the cam surface **282** moves out of engagement with the button **284**, and thereby turns off the valve **262**, the cam surface **281** engages the button **283** and turns on the valve **261** for the dancer roller **178**. Then, with the valve **262** for the blow tube turned off, the valve **261** for the dancer roller remains on for approximately a 65° arc of the revolution of the cam **258**. After the cam **258** has turned through the 65° arc, the cam surface **281** moves out of engagement of the button **283** and turns off the valve **261**. Both valves **261** and **262** then remain off until the cam **258** has turned sufficiently far for the cam surface **282** to again move into engagement with the button **284** and turn on the valve **262** during the next wrapping cycle. As will be explained hereinafter, the operation of the valves **261** and **262** is synchronized with the wrapping mechanism such that they are turned on from approximately the time that the film is begun to be severed until the film is moved to the suction baffle plate **179**.

During each wrapping cycle, the top plunger **82** moves rearwardly of the machine and pushes the article from the top elevator **72** rearwardly toward the plate **81**. During such rearward movement of the article, the film **121** is folded underneath the article and portions of the film overlap. Adjacent the forward edge of the plate **81** is provided a tack sealer **291** (FIGS. 1 and 5) which tack seals the overlapped portions of the film before the film is severed. Plastic films tend to stick to hot objects, and the tack sealer **291** is constructed to eliminate this difficulty. The tack sealer **291** extends laterally of the machine at the forward edge of the plate **81**, and is mounted in an angle shaped bracket **292** (FIGS. 5 to 7) which is secured to the frame of the machine as by bolts. The tack sealer **291** comprises a cylindrical heater cartridge **293** fastened to the bracket **292** by blocks **294** which are secured to the ends of the cartridge **293** and to the bracket **292**. The cartridge **293** includes a suitable heating element **296**, which is connected to an electrical supply by suitable conductors **297** (FIG. 7). The cartridge **293** further includes a thermostat **298** which is connected in the power supply control circuit for the heating element **296**. The thermostat **298** may be a conventional type, such as a fluid filled bulb, and is preferably accurate enough to hold the temperature of the heating cartridge to a maximum variation of 10 to 15° F. It is preferred that the temperature of the tack sealer **291** be adjustable within the range of 200 to 500° F., depending upon the particular type of film being used.

The tack sealer **291** further includes a thin walled tubular metal roller **301** (FIG. 8) which has an inner diameter somewhat greater than the outer diameter of the heating cartridge **293**. The roller **301** is rotatably mounted on the heater cartridge **293** between the two mounting blocks **294** which prevent substantial longitudinal movement of the roller **301** relative to the heater cartridge **293**. Further, a coating **302** of non-stick material, such as Teflon, is preferably formed on the roller **301**, and the roller **301** is preferably made of a high heat conducting material such as aluminum.

During the operation of the machine, energization of the heating element **296** causes the cartridge **293** to heat up to operating temperature. The portion of the roller **301** at the top side of the tack sealer becomes hotter than the other portions because the top portion is in direct contact with the cartridge **293**. The remainder of the roller **301** is at a lower temperature because it is out of direct contact with the cartridge **293**, as shown in FIG. 8. As an article is pushed from the top elevator **72** toward the plate **81**, the rearward edge of the article engages the roller **301** and causes the roller **301** to rotate in the clockwise direction as seen in FIGS. 6 and 8 as the package moves over the top of the tack sealer. Even though the roller **301** is hot, it is not sufficiently hot to damage or seal the film because the article and the roller **301** are moving. With such movement of the article, no one portion of the film remains in contact with the roller **301** for any length of time, and the movement of the roller, because it is in contact with the heater therein only at the upper side of the roller, results in constantly changing the portions of the roller that have to be brought up to heat. Thus, so long as the article and roller are moving, insufficient heat is imparted to the film to effect sealing. Further, the coating **302** of Teflon helps to prevent the film from sticking to the roller.

After the film has been wrapped around the article and overlapped and the overlapped portions are over the tack sealer, movement of the article is stopped momentarily. With no movement of the article, the roller **301** also stops turning and the upper portion of the roller **301**, which is in direct contact with the heating cartridge **293**, rapidly becomes heated to a greater extent. The pause in the movement of the package, while the overlapped portions of the film are over the tack sealer and before the film has been severed, is long enough for the upper portion of the roller to heat up and tack seal the film. The weight of the

article being wrapped presses the overlapped portions of the film against the roller **301** during the tack sealing operation.

The pause in the movement of the article, during which tack sealing takes place, may be produced by constructing the cam which moves the plunger **82** such that the plunger, and thus the article, stops while the overlapped portions of the film are over the tack sealer and then moves rearwardly again to its maximum rearward position. A pause may also be produced by making the maximum rearward position of the plunger occur when the overlapped portions of the film are over the tack sealer, and timing the movement of transport arms **311**, which push the articles rearwardly after they have been pushed on to the plate **81** by the plunger **82**, such that the article momentarily remains stationary before the arms **311** engage and move the article. In practice, it may be desirable to have two pauses, and consequently two tack seals, one produced by the cam construction and the other produced by the timing of the plunger **82** and the arms **311**.

After the film around an article has been sealed and severed, the article is pushed by the top plunger **82** onto the plate **81** which forms part of an end folding apparatus **316** (FIGS. 1, 15 and 16). As described in the previously referred to patent applications, the transport arms **311** are arranged in pairs, the arms of each pair being laterally spaced, and are attached to a pair of laterally spaced chains **312** which are trained around two pairs of sprockets **313** and **314** (FIGS. 1 and 16). The sprockets are mounted on suitable shafts for rotation on the frame of the machine, and are preferably connected by chains and sprockets to be driven by the main drive motor **252** such that the chains **312** rotate continuously during operation in the counterclockwise direction as seen in FIG. 1. The movement of the transport arms **311** is timed with the remainder of the wrapping mechanism such that one pair of the arms **311** moves to a position adjacent the forward edge of the plate **81** after each article has been pushed from the top elevator **72** to the plate **81**. As previously stated, the timing is preferably such that the article is momentarily stationary while over the tack sealer after it has been moved by the plunger **82** and before it is engaged by the arms **311**.

The arms **311** move the articles across the plate **81** of the end folding apparatus **316**, which is described in detail in the above Hansen et al. patent application and is partially shown in FIGS. 15 and 16. The end folding mechanism **316** draws the film tightly in the lateral direction across the top and bottom sides of the film, and folds the ends of the film underneath the article. After the ends of the film have been folded under the article, the articles are moved by the transport arms **311** from the plate **81** onto a main heat sealer **317** (FIGS. 1, 15 and 16). The main sealer **317** comprises a heating element **318** having a flat, horizontal upper surface **319**, and an endless belt **321** which is trained around a drive roller **322** and an idler roller **323**. The drive roller **322** is connected by a chain **324** to be driven from the main drive motor **252** of the wrapping machine, the chain **324** preferably also being connected through a sprocket **326** to rotate the sprockets **313** and **314** and the transport arms **311**. The chain **324** may, for example, mesh with a sprocket **327** which in turn is connected by gears to rotate the drive roller **322** in the clockwise direction as seen in FIGS. 1 and 15. The belt **321** is driven by the roller **322** in the clockwise direction, and the belt **321** engages and sweeps across the upper surface **319** of the heater **318**. To maintain tension on the belt **321**, a tension member **328** is connected to the lower end of a tension bar **329** which is pivotally mounted on the frame of the machine by a pin **331**. The member **328** engages the inner surface of the belt **321** and presses the lower portion of the belt downwardly, and thereby tensions the belt **321**.

To ensure that the film on the underside of the article is pressed firmly against the belt **321**, two pairs of rollers **332** are mounted on the frame of the machine above the main sealer **317** and adjacent the longitudinally extending sides thereof. As explained in the previously mentioned Hansen et al. patent application, the articles are moved over the main sealer underneath the rollers **332**, which are mounted such that they may swing upwardly in the counterclockwise direction as seen in FIG. 15 as the longitudinally extending sides of the articles move underneath the rollers **332**, and the weight of the rollers **332** presses the article firmly against the main sealer **317**.

During the operation of the end folding apparatus **316** and the main sealer **317**, the transport arms **311** move the articles along the plate **81** of the apparatus **316** where the ends of the film are folded underneath the article, and onto the main sealer **317**. The belt **321** is rotated such that its surface speed is the same as the speed of the article. The belt **321** is preferably made of fiber glass which is impregnated with Teflon, the Teflon again preventing or reducing the chance that the belt **321** will stick to the film on the underside of the article. The portion of the belt **321**, between the article and the main heater **318**, becomes heated by the heater **318** and it transfers the heat to the film underneath the article and seals the film.

At the rearward end of the main heater **317** may be provided an output conveyor **326** (FIG. 1). The transport arms **311** move the article past the main sealer **317** and to the output conveyor **326**, and the latter conveyor **326** may carry the articles either to a bin or to an input of a transport and labeling machine. The conveyor **326** may have either a positive drive for moving the articles from left to right as seen in FIG. 1 or it may be inclined sufficiently for the articles to move along it due to the force of gravity.

FIGS. 17 to 23 illustrate schematically the successive stages in one wrapping cycle when an article **341** is girdle wrapped in the film **121**. The stage shown in FIG. 17 occurs just after the article **341** has been moved from the infeed conveyor mechanism **54** onto the bottom elevator **71**. At the same time, a preceding article **342** has been moved off from the top elevator **72** and onto the plate **81** of the end folding apparatus **316**. The two elevators **71** and **72** are at their vertically displaced positions, and the free end of the film **121** is on the shelf **183** of the suction baffle plate **179** and is being held thereby. The dancer roller **178** is being supported by the stationary stops and both air valves **261** and **262** are turned off.

In FIG. 18, the two elevators **71** and **72** have been moved to the intermediate positions where they are horizontally aligned. The lifts **193** attached to the bottom elevator **71** engage the underside of the dancer roller **178** during upward movement of the bottom elevator **71** and lift the dancer roller upwardly, to the position shown in FIG .18, where the bottom plunger **83** may move the article from the bottom elevator **71** to the top elevator **72**, as shown in FIG. 19. As the article **241** is being transferred from one elevator to the other, it engages the film and slides over the free end of the film **121**, as it slides onto the top elevator **72**. The free end portion of the film **121** is drawn off of the shelf **183** of the suction baffle plate **179** as the article **341** is pushed onto the top elevator **72**. As shown in FIG. 19, the dancer roller **178** is still in the raised position where it is supported by the lifts **193**.

After the article **341** has been transferred to the top elevator **72**, the two elevators **71** and **72** shift to their vertically displaced positions (FIG. 20), and the film is folded over the top of the article **341** and downwardly on its rearward side. From the rearward side of the article **341**, the film **121** extends downwardly and underneath the dancer roller **178**, and then upwardly to the stationary draper shaft **177** and over the plate **168**. When the bottom elevator **71** moves downwardly, the lifts **193** permit the dancer roller **178** to drop until the blocks at the ends of the dancer roller **178** engage the movable stops **196**. The

stops **196** are located such that the free end portion of the film, after severing, will be sufficiently long for the next succeeding cycle.

With reference to FIG. 21, the top plunger **82** pushes the article from the top elevator **72** over the tack sealer **291** and on to the plate **81**. After the section of film **121** being wrapped around the article has overlapped the free end thereof, and the overlapped portions of the film are over the tack sealer **291**, the movement of the article **341** is stopped momentarily and the overlapped portions of the film are tack sealed together. After the tack sealing operation has been completed, the movable blade **106** of the severing means is moved rearwardly to sever the section of film around the article from the supply. The cam **285** is positioned on the shaft **251** such that, at substantially the same time that the blades begin to sever the film, the valve **262** controlling the flow of air to the blow tube **236** is opened by the cam **258** and consequently jets of air blow through the holes **239** and **241** formed in the blow tube **236**. The jets of air from the holes **239** blow substantially forwardly of the machine and the jets of air from the holes **241** blow substantially downwardly, and consequently the jets of air from the holes **239** and **241** tend to push the free, severed end of the film **121** forwardly and the jets of air increase the air pressure in the space within the portions of the film, which are looped under the dancer roller.

The valve **262** remains open during the severing operation, and at the completion of the severing operation, the movable stops **196** are moved forwardly out of engagement with the blocks at the ends of the dancer roller **178**, permitting the dancer roller **178** to fall. At substantially the time that the film is completely severed, the dancer roller **178** begins to fall, the valve **262** is closed, and the other valve **261** is opened by the cam **258**, and jets of air issue from the holes **233** formed in the dancer roller **178**. The holes **239** are located such that the jets of air are directed substantially downwardly, downwardly and forwardly, and upwardly and forwardly. The valve **261** remains open during the time that the dancer roller **178** is falling from the movable stops **196** to the stationary stops **194**, and the valve **261** is turned off after the dancer roller **178** has come to rest on the stops **194**. As shown in FIGS. 1 and 6, the stops **194** are located such that the dancer roll **178** is spaced a short distance above the upper surface of the shelf **183** of the suction baffle plate **179**. Thus, as the dancer roll **178** falls downwardly, the jets of air issuing from the holes **233**, and the weight of the dancer roll push the free end portion of the film **121** downwardly toward the suction baffle plate **179**, which receives the film and holds the film in the position shown in FIG. 17 in preparation for the next wrapping cycle. The next succeeding package **343** is then moved through the cycle shown in FIGS. 17 through 23.

Thus, the air jets from the blow tube **236** and the dancer roller **178** slightly increase the air pressure between the looped portions of the film and they blow against the severed end portion of the film to prevent it from falling rearwardly. In addition to preventing the free end portion of the film from becoming tangled, the dancer roller **178** also speeds up the rate of operation of the machine since it pushes the free end portion of the film downwardly, rather than simply permitting the film end portion to fall freely.

In FIGS. 24 through 28 is shown alternate apparatus for controlling the free end portion of the film after it has been girdle wrapped around an article, tack sealed and severed, to prevent the free end portion of the film from falling back upon itself or otherwise becoming tangled. The structure shown in FIGS. 24 to 28 comprises bottom and top elevators **71***a* and **72***a*, respectively, a bottom plunger **83***a*, a stationary draper shaft **177***a*, a dancer roller **178***a*, a stationary cutting blade **106***a*, a movable cutting blade **107***a*, a plate **81***a* of an end folding apparatus, and a tack sealer **291***a*. The foregoing components are generally similar to the corresponding components of the previously described form of the invention. The dancer roller **178***a* is again movable in a generally vertical plane. The dancer roller **178***a* may be moved by a pair of cam actuated arms **345** attached to the ends of the dancer roller **178***a*, the arms **345** being moved by the main drive mechanism of the machine and moving the dancer roller in timed relation with the other parts of the wrapping machine.

The structure shown in FIGS. 24 to 28 further includes a suction control plate or box **346** which is located underneath the top elevator **72***a* and is vertically movable with the elevator **72***a*. The box **346** may be attached to the cutting blades **107***a* and be movable longitudinally of the machine with the movable cutting blades **107***a*. The control box **346** has a plurality of holes **347** formed in its rearward face **348**, and the control box **346** is connected by suitable flexible conduits **349** to a suction producing device **350** such as an air pump.

After an article has been moved on to the bottom elevator **71***a* and the two elevators are in the intermediate, or horizontally aligned positions, the end of the film **121***a* is held by the control box **346**. When the bottom plunger **83***a* pushes the article **341***a* against the film **121***a* and on to top elevator **72***a*, the film is peeled upwardly off of the rearward face of the control box **346**. Subsequently, the two elevators are moved to their vertically displaced positions and the film **121***a* is folded over the top of the article and downwardly on its rearward side (FIG. 26), and the film extends around the underside of the dancer roller **178***a* which is moved downwardly by the arms **345** and maintains tension on the looped film. The pusher **82***a* (FIG. 27) then moves rearwardly of the machine and pushes the article from the top elevator **72***a* onto the plate **81***a*. During this portion of the cycle, the film is folded underneath the article. After the film has overlapped its free end and been tack sealed, cutting blades **107***a* move rearwardly and sever the film (FIG. 27). The dancer roller **178***a* at this time is located to provide a new length of film of the right dimension. The control box **346***a* also moves rearwardly with the movable cutting blades **107***a*, and as soon as the film **121***a* has been severed, it is immediately drawn to the control box **346** by the suction therein and held against the rearward face of the control box **346**. Thereafter the top elevator **72***a* moves downwardly (FIG. 28), carrying the control box **346** with it, and the dancer roller **178***a* is also moved downwardly by the arms **345** at approximately one-half the speed of the top elevator and maintains tension on the loop film. Downward movement of the control box **346** relative to the draper shaft **177***a* causes the portion of the film **121***a* being held against the rearward face **348** of the control box, to be gradually peeled upwardly off of the face **348**, and when the elevators reach the horizontally aligned positions shown in FIG. 24, only a relatively short end portion of the film **121***a* is still being held by the control box **346**. The box **346** then maintains tension on the suspended length of film and the dancer roller **178** is raised to the position shown in FIG. 24 in preparation for the next cycle.

Thus, in the form of the invention shown in FIGS. 24 to 28, the end portion of the film **121***a* is positively held by the control box **346** and controlled thereby, from the time that the section of film around the article has been severed from the supply until the film is engaged by the next succeeding package. There is no opportunity for the free end portion of the film to become tangled or to become folded upon itself. An advantage of having the film gradually peeled off of the face **348** of the box **346** is that wrinkling of the film is prevented. In a wrapping machine including the structure shown in FIGS. 24 to 28, the portions of the wrapping machine not illustrated may be the same as those shown in FIGS. 1 to **23**.

FIGS. 29 through 33 show another form of the invention which is generally similar to the form shown in FIGS. 24 to 28 but which differs in the means provided to attract and hold the severed end portion of the film. The structure shown in FIGS. 29 to 33 comprises bottom and top elevators **71***b* and **72***b*, respectively, bottom and top pushers **83***b* and **82***b*, respectively, blades **106***b* and **107***b* of a severing means, a dancer roller **178***b*, arms **345***b*, a draper shaft **177***b*, and a plate **81***b* of an end folding mechanism. In place of the suction control box **346** for holding the film, shown in FIGS. 24 to 28, there is provided a plate **351** which holds the end portion of the film **121***b* by electrostatic attraction. The structure also includes a source **352** of static electricity. One pole of the source **352** is grounded as at **353** and the other pole of the source **352** is connected to a brush **354** which is positioned to engage the film **121***b* downstream from the draper shaft **177***b*. The plate **351** is also grounded as at **356**. The dancer roller **178***b* is movable in the manner described with regard to FIGS. 24 to 28, and the other portions of the machine may be the same as that shown in FIGS. 1 to 16.

During operation, the free end portion of the film **121***b* is held by the plate **351** due to electrostatic attraction. When the elevators **71***b* and **72***b* are in the intermediate positions, the article **341***b* is moved from the bottom elevator onto the top elevator by the bottom pusher **83***b*, and the film is peeled off of the plate **351**, as previously described. Thereafter, the elevators are moved to their vertically displaced positions and the film **121***b* is folded over the top of the article and downwardly on the rearward side of the article. As film is fed into the wrapping mechanism during the wrapping cycle, the film passes by and engages the brush **354** which places an electrostatic charge on the film.

The plate **351** is preferable attached to and movable with the movable cutting blades **107***b*, and after the section of the film around the article has been overlapped and tack sealed, the blades **107***b* move rearwardly and sever the section of film from the supply. The plate **351** also moves rearwardly with the blades **107***b*, and the attraction of the plate **351** for the free end portion of the film **121***b* causes the film to be drawn to and then held by the rearward face of the plate **351**. Subsequently, during downward movement of the top elevator **72***b*, the free end portion of the film is gradually peeled off of the rearward face of the plate **351**, until, when the top elevator **72***b* has reached the intermediate position, only a relatively small end portion of the film **121***b* is being held by the plate **351**. Thus, as in the previously described embodiments the free end portion of the film after severing is controlled and prevented from clinging to other portions of the wrapping machine or from folding upon itself.

In FIGS. 34 to 42 is illustrated still another alternative apparatus for controlling the free end portion of the film after the severing operation. The structure in FIGS. 24 to 42 comprises bottom and top elevators **71***c* and **72***c*, respectively, a lift **193***c* attached to the bottom elevator **71***c* for picking up a dancer roller **178***c*, blades **106***c* and **107***c* of a severing means, a tack sealer **291***c*, a plate **81***c* of an end folding apparatus, a draper shaft **177***c* from which the end portion of the film **121***c* is suspended, and a suction baffle plate **179***c* which may be similar to the plate **179** shown in FIG. 6.

The dancer roller **178***c* is shown in detail in FIG. 42, and is a rake-like member including a laterally extending shaft **360** and a plurality of laterally spaced fingers **361** secured to and extending radially outward from the shaft **360**. The fingers are preferably made of a material such as Teflon and, if desired, may be somewhat flexible. The shaft **360** is mounted for vertical movement on the frame of the machine and is movable between an upper position shown in FIG. 34 where it is supported by the lifts **193***c* attached to the bottom elevator **71***c*, and a lower position shown in FIG. 41, where it may be supported either by lifts attached to the top elevator, as described in the Littlefield application, or by stops **365** fastened to the frame of the machine, as described in the Hansen et al. application. While supported by the stops **365**, the shaft **360** is supported at substantially the same position as the dancer roller **178** while it is being supported by the movable stops. Further, biasing means, such as a pair of torsion springs **362** (FIG. 40 and FIG. 42) is preferably provided for urging the shaft **360** and the fingers **361** in the counterclockwise direction as seen in FIG. 40. The torsion springs **362** may be positioned around the ends of the shaft **360** and have one end anchored to the shaft and the other end anchored to the frame of the machine, and be tensioned to bias the shaft **360** in the counterclockwise direction.

During the operation of the wrapping mechanism, the film **121***c* is initially at the position shown in FIG. 34 where the end portion is held by the suction baffle plate **179***c*. The article **341***c* to be wrapped is pushed by the bottom plunger **83***c* from the bottom elevator **71***c* to the top elevator **72***c*, causing the article to slide over the end of the film, as shown in FIG. 35. During this portion of the wrapping cycle, the shaft **360** is held in the upper position by the lifts **193***c*, and the fingers **361** are caused to swing clockwise since they rest on the film. Thereafter, the elevators are moved to their vertically displaced positions and the film is drawn over the top of the article and downwardly on the rearward side of the article. At the same time, the shaft **360** moves downwardly and the fingers **361**, which rest on the upper surface of the film during the upward movement of the top elevator **72***c* and the article, swing about the axis of the shaft **360** in the clockwise direction until they are substantially vertical as shown in FIGS. 36 to 39. After the elevators have reached the vertically displaced positions, the top plunger **82***c* pushes the article from the top elevator onto the plate **81***c*, and after the film has been tack sealed, the blades **106***c* and **107***c* sever the section of the film around the article from the supply. As soon as the film has been severed, the fingers **361** swing in the counterclockwise direction as shown in FIGS. 40 and 41 due both to the action of the springs **362** and to the force of gravity, and the fingers lay the free end portion of the film **121***c* on top of the suction baffle plate **179**. Thereafter, when the elevators are moved to the intermediate positions, the lifts **193***c* attached to the bottom elevator again pick up the shaft **360** and move it up out of the way to permit another article to be pushed on to the top elevator **72***c*.

Instead of having the shaft **360** supported by the lifts **193***c* and by the stationary stops **365** it may be desirable to connect the shaft **360** to be supported by arms or other mechanisms, which would move the dancer roller **178***c* upwardly and downwardly in timed relation with the other mechanisms of the wrapping machine. Such a mechanism would preferably also turn the shaft **360** and the fingers **361** first in the clockwise direction as the top elevator is moving downwardly, and then in the counterclockwise direction after the film has been severed.

From the foregoing description, it will be apparent that a novel wrapping machine has been provided which is capable of handling extremely thin, plastic films. The wrapping machine includes a novel stripper roller for removing the film from the supply roll. The preferred form of the wrapping machine further includes a novel film control means, comprising the air blowing apparatus and the air suction apparatus for controlling the free end portion of the film after it has been severed and suspending a new length of film for the subsequent wrapping cycle. The wrapping machine further includes a novel tack sealer which will not stick to the plastic film though it is hot, but which is capable of heat sealing the overlapped portions of the film. Similarly, the novel main heater of the wrapping machine also will not stick to the film even though it is hot but is nevertheless capable of

creating a firm seal at the bottom of the fully wrapped package. In addition to the preferred embodiment of the invention which includes the air blowing and suction apparatus, there are also disclosed alternative film control means. The film may be controlled by a plate which attracts and yieldably holds the end portion of the film, as by suction or electrostatic force, or by fingers attached to the dancer roller, and a suction baffle plate.

We claim:

1. A wrapping machine for wrapping articles in a thin protective film, comprising a wrapping mechanism for wrapping articles in the film, and a film feed and transport mechanism for feeding film into the wrapping mechanism and holding the film under tension during each wrapping cycle, said film feed and transport mechanism comprising an arbor adapted to rotatably support and drive a supply roll of the film, film tensioning means located in the path of the film between said supply roll and said wrapping mechanism and adapted to have the film trained thereover and maintain tension on the film, a stripper roller located in the path of the film between the supply roll and said tensioning means and adapted to have the film trained thereover, and drive means connected to said arbor and to said stripper roller for rotating said arbor and said stripper roller to cause said stripper roller to strip film from said supply roll.

2. A wrapping machine as in claim 1, wherein said drive means rotates said stripper roller and said arbor such that the surface speed of said stripper roller tends to be greater than the surface speed of the film supply roll on said arbor.

3. A wrapping machine as in claim 1, and further including a slip clutch between said drive means and said stripper roller.

4. A wrapping machine as in claim 3, and further including means for adjusting the amount of slip of said slip clutch and therefore the amount of tension on the portion of film between said supply roll and said stripper roller.

5. A wrapping machine as in claim 1, wherein said stripper roller includes friction means on its outer periphery for gripping the film, the tension on the film by said tensioning means holding the film against said friction means.

6. A wrapping machine for wrapping articles in a thin protective film, including a wrapping mechanism for wrapping articles in the film, and a film feed and transport mechanism for feeding film into the wrapping mechanism during each wrapping cycle, said film feed and transport mechanism comprising an arbor adapted to rotatably support a supply roll of the film, film tensioning means located in the path of the film between said supply roll and said wrapping mechanism and adapted to have the film trained thereabout and maintain tension on the film, a stripper roller located in the path of the film between the supply roll and said tensioning means and adapted to have the film trained thereabout, and drive means connected to said stripper roller for intermittently rotating said arbor and said stripper roller to cause said stipper roller to strip film from said supply roll, the surface friction alone between said stripper roller and said film being sufficient to enable said stripper roller to pull said film and thereby strip the film from said supply roll.

7. A wrapping machine as in claim 6, and further including a clutch mechanism interposed between said drive means and said stripper roller.

8. A wrapping machine as in claim 6, and further including means connected to be actuated by said tensioning means for effecting a driving connection between said drive means and said stripper roller.

9. A wrapping machine for wrapping an article in a protective film, comprising a film feed and transport mechanism including a draper device, a wrapping mechanism, said feed and transport mechanism delivering film from a film supply to said wrapping mechanism and suspending a length of film from said draper device before each wrapping cycle, said wrapping mechanism including elevator means, dancer means, film severing means, and article moving means, all of said means cooperating in each wrapping cycle to move the article such that the forward side of the article engages said length of film and the article rests on the end portion of said film, and to fold the film over the top of the article, downwardly on the rearward of the article, and underneath the article, whereby a first portion of the film extends from said draper device downwardly and underneath said dancer means, a second portion of the film extends from said dancer means upwardly to the article in spaced relation to said first portion, and a third portion of the film extends around the article and overlaps on the underside of the article, said severing means severing said third portion of film from said second portion of film, said wrapping mechanism further including film control means operating in conjunction with said dancer means on said first and second portions of film to hold said first and second portions of film separated and to move said first and second portions into position to form a new length of film for a subsequent wrapping cycle, said dancer means comprising a tubular member having a plurality of holes formed through the wall thereof, and said film control means comprising air supply apparatus connected to the interior of said tubular member, whereby air from said air supply appartus flows into the interior of said tubular member, out of said holes, and into the space between said first and second portions of the film, whereby air pressure in said space is increased and holds said first and second portions of film apart.

10. A wrapping machine as in claim 9, wherein said holes in said tubular member are located to direct jets of air generally in the forward and downward directions.

11. A wrapping machine as in claim 9, wherein said wrapping mechanism further includes guides engaging the ends of said dancer means and permitting substantially vertical movement of said dancer means but preventing turning movement of said dancer means about its axis, and said holes in said tubular member are located to produce jets of air which are directed generally in the forward and downward directions.

12. A wrapping machine as in claim 9, wherein said wrapping mechanism further includes guide means engaging the ends of said dancer means for permitting and guiding movement of said dancer means in a generally vertical direction, said dancer means being supported during different portions of each wrapping cycle by lifts attached to said elevator means, by stationary stops attached to said guide means, or by movable stops attached to said guide means, said stationary stops supporting said dancer means when the latter is in its lowermost position and said lifts supporting said dancer means when the latter is in its uppermost position, and said movable stops supporting said dancer means at a location which is intermediate said lowermost position and said uppermost position.

13. A wrapping machine as in claim 12 wherein said dancer means is supported by said lifts at said uppermost position while the article is being moved into engagement with said length of film and the article rests on the end portion of said length of film, said dancer means is supported by said movable stops at said intermediate position while the film is being folded over the top of the article and downwardly on the rearward side of the article and underneath the article, and said dancer means is supported by said stationary stops at said lowermost position at the beginning of the subsequent wrapping cycle.

14. A wrapping machine as in claim 13, wherein said wrapping mechanism further includes actuators for moving said movable stops out of supporting engagement with said dancer means at the time that said film is severed.

15. A wrapping machine as in claim 9, wherein said dancer means further comprises a plurality of rollers rotatably positioned on said tubular member.

16. A wrapping machine as in claim 15, wherein said last named means holds said rollers in axially spaced relation, and said plurality of holes formed through the wall of said tubular member are located in the spaces between said rollers.

17. A wrapping machine as in claim 16, wherein a set of three holes is formed in each of said spaces, one hole of each set being located to direct a jet of air generally downwardly, a second hole of each set being located to direct a jet of air generally downwardly and forwardly, and the third hole of each set being located to direct a jet of air generally upwardly and forwardly.

18. A wrapping machine as in claim 9, wherein said film control means further comprises a blow tube located above said dancer means and connected to said air supply apparatus, said blow tube having a plurality of holes formed through the wall thereof, whereby air from said air supply apparatus also flows into the interior of said blow tube, out of said holes formed in said blow tube, and into said space between said first and second portions of film.

19. A wrapping machine as in claim 18, wherein said film control means further comprises air control means for controlling the flow of air from said air supply apparatus to said dancer means and to said blow tube, said air control means being synchronized with the operation of said wrapping mechanism such that air is directed to said blow tube at least from substantially the time that said severing means begins to sever the film until the film is completely severed, and air is directed to said dancer means at least from substantially the time that the film is completely severed until a new length of film has been suspended in the subsequent wrapping cycle.

20. A wrapping machine as in claim 19, wherein said film control means further includes a stationary suction baffle plate positioned to engage and hold the end portion of the suspended length of film at the beginning of each wrapping cycle.

21. A wrapping machine as in claim 20, wherein said blow tube is stationary and is located substantially vertically above said suction baffle plate and said dancer means, and said dancer means is movable in a substantially vertical plane from a first position adjacent said blow tube, to a second position intermediate said blow tube and said baffle plate, and to a third position adjacent said suction baffle plate, said wrapping mechanism including means for supporting said dancer means at said first position while the article is being moved on to the end portion of the film, means for supporting said dancer means at said second position while the film is being folded underneath the article and overlapped, and means for supporting said dancer means at said third position at the beginning of each wrapping cycle.

22. A wrapping machine for wrapping an article in protective film, comprising a film feed and transport mechanism including a draper device, a wrapping mechanism, said feed and transport mechanism delivering film from a film supply to said wrapping mechanism and suspending a length of film from said draper device before each wrapping cycle, said wrapping mechanism including elevator means, dancer means, film severing means, and article moving means, all of said means cooperating in each wrapping cycle to move the article such that the forward side of the article engages said length of film and the article rests on the end portion of said film, and to fold the film over the top of the article, downwardly on the rearward of the article, and underneath the article, whereby a first portion of the film extends from said draper device downwardly and underneath said dancer means, a second portion of the film extends from said dancer means upwardly to the article in spaced relation to said first portion, and a third portion of the film extends around the article and overlaps on the underside of the article, said severing means severing said third portion of film from said second portion of film, said wrapping mechanism further including film control means operating in conjunction with said dancer means on said first and second portions of film to hold said first and second portions of film separated and to move said first and second portions into position to form a new length of film for a subsequent wrapping cycle, said film control means comprising a blow tube located in a space between said first and second portions of film, air supply apparatus connected to said blow tube, said blow tube having a plurality of holes formed through the wall thereof, whereby air from said air supply apparatus flows into said blow tube, out of said holes, and into said space between said first and second portions of film, whereby pressure in said space is increased to hold said first and second portions of film apart.

23. A wrapping machine as in claim 22, wherein said holes in said blow tube are located to direct jets of air generally downwardly and forwardly.

24. A wrapping machine for wrapping an article in a protective film, comprising a film feed and transport mechanism including a draper device, a wrapping mechanism, said feed and transport mechanism delivering film from a film supply to said wrapping mechanism and suspending a length of film from said draper device before each wrapping cycle, said wrapping mechanism including elevator means, dancer means, film severing means, and article moving means, all of said means cooperating in each wrapping cycle to move the article such that the forward side of the article engages said length of film and the article rests on the end portion of said film, and to fold the film over the top of the article, downwardly on the rearward of the article, and underneath the article, whereby a first portion of the film extends from said draper device downwardly and underneath said dancer means, a second portion of the film extends from said dancer means upwardly to the article in spaced relation to said first portion, and a third portion of the film extends around the article and overlaps on the underside of the article, said severing means severing said third portion of film from said second portion of film, said wrapping mechanism further including film control means operating in conjunction with said dancer means on said first and second portions of film to hold said first and second portions of film separated and to move said first and second portions into position to form a new length of film for a subsequent wrapping cycle, said film control means being attached to said elevator means and being located adjacent and forwardly of said second portion of film at the time that said film is being severed, said film control means being constructed to attract said second portion of film after the film has been severed and to act in conjunction with said dancer means to hold said second portion of film and to maintain the film under tension until the beginning of the subsequent wrapping cycle.

25. A wrapping machine as in claim 24, wherein said film control means comprises a suction baffle plate, means for producing a vacuum connected to said suction baffle plate, and said suction baffle plate having a plurality of holes formed in its side which is adjacent said second portion of film, whereby said second portion is attracted to and held by the suction of said baffle plate.

26. A wrapping machine as in claim 24, wherein said elevator means moves downwardly after said severing means has severed the film, such downward movement of said elevator means carrying said film control means downwardly, and said second portion of film being peeled upwardly off of said film control means during such downward movement of said film control means.

27. A wrapping machine as in claim 24, wherein said film control means comprises a plate, a source of electrostatic charge, one pole of said source being connected to

engage the film and impart a charge of one polarity to the film, means connecting the other pole of said source to said plate whereby said plate and said film are oppositely charged and therefore said second portion of the film is attracted to said plate after the film is severed.

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