May 21, 1968 O. R. TITCHENAL ETAL 3,383,825

WRAPPING MACHINE AND METHOD

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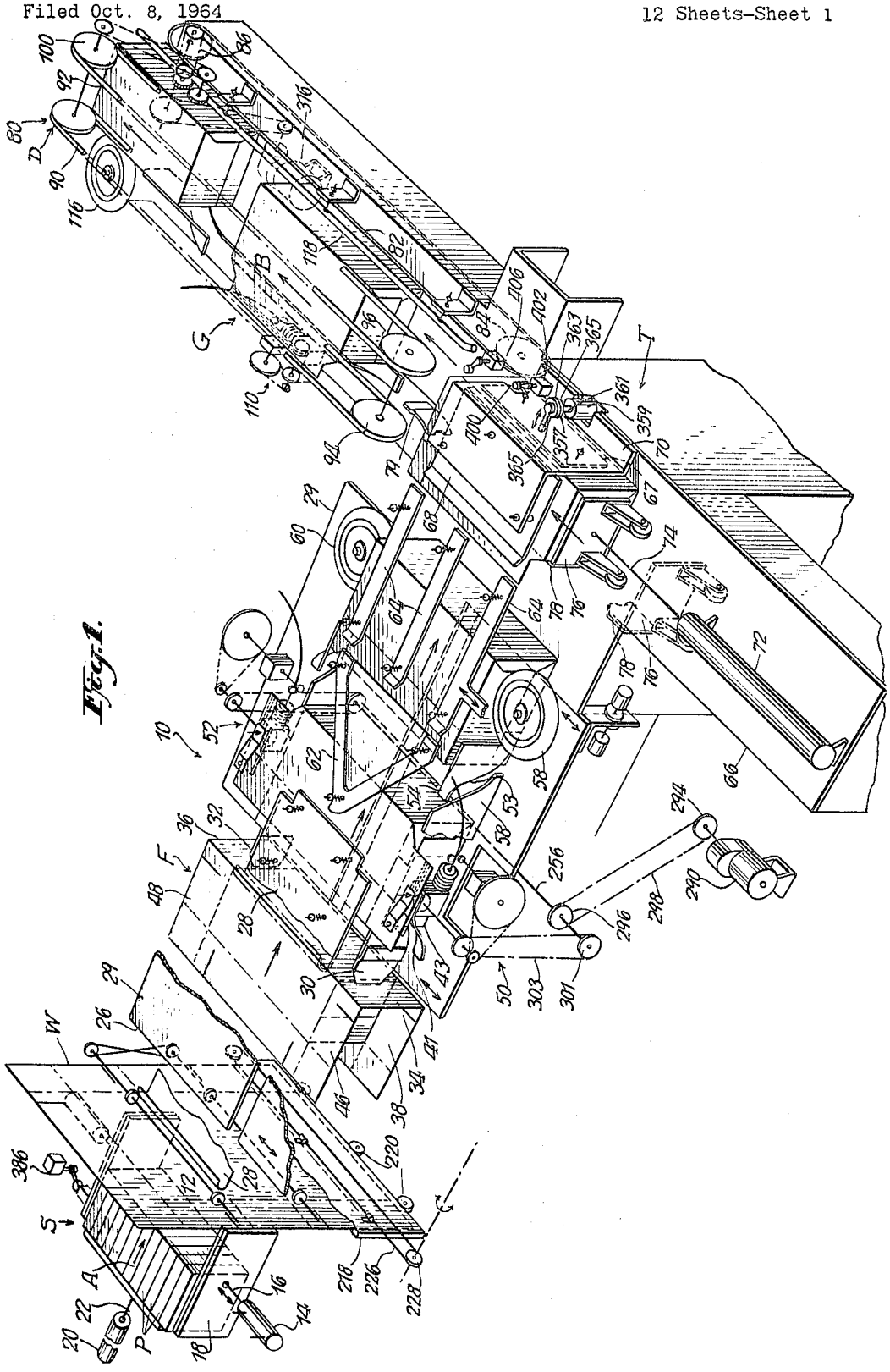


Fig. 1.

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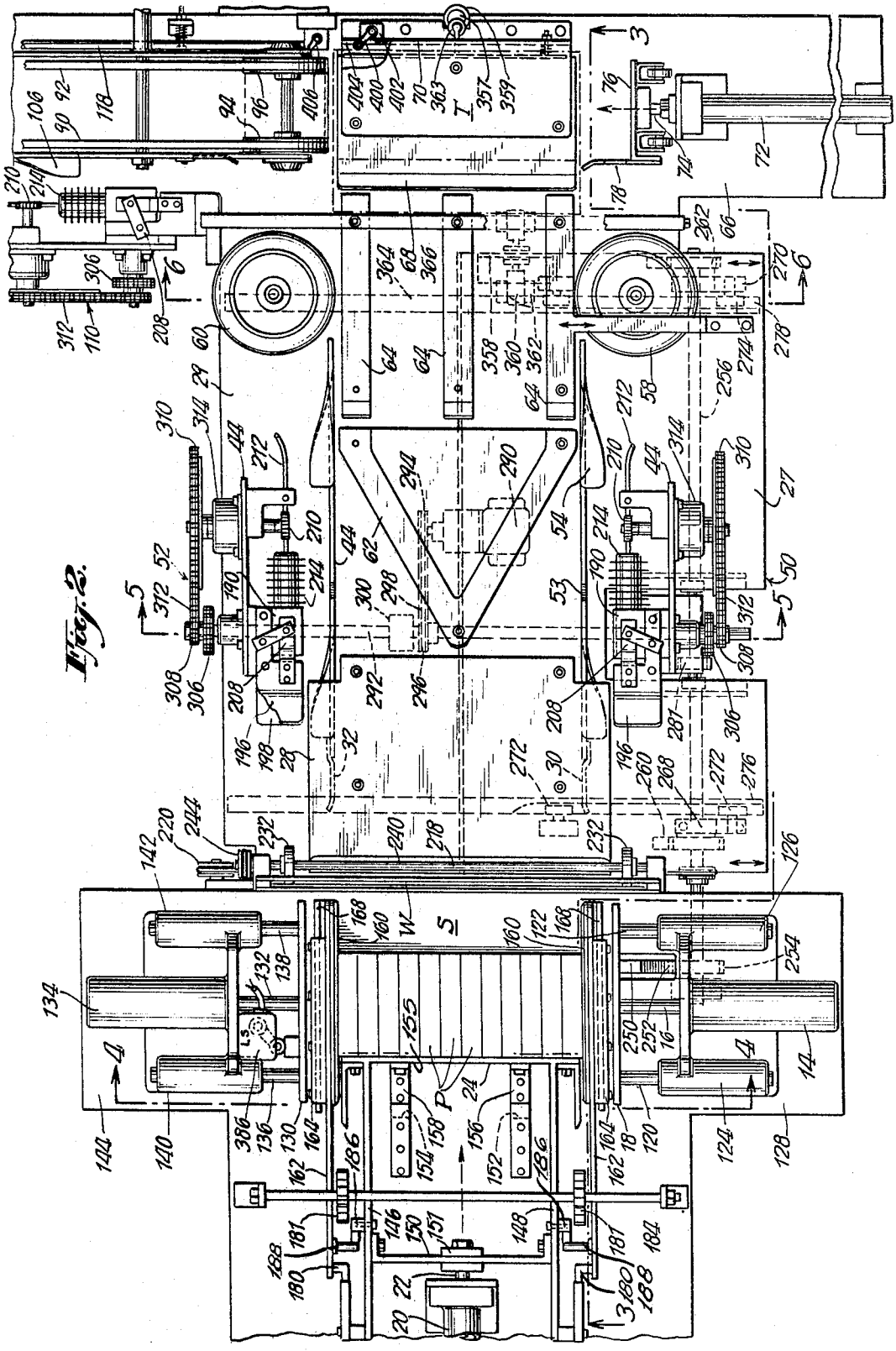


Fig. 2.

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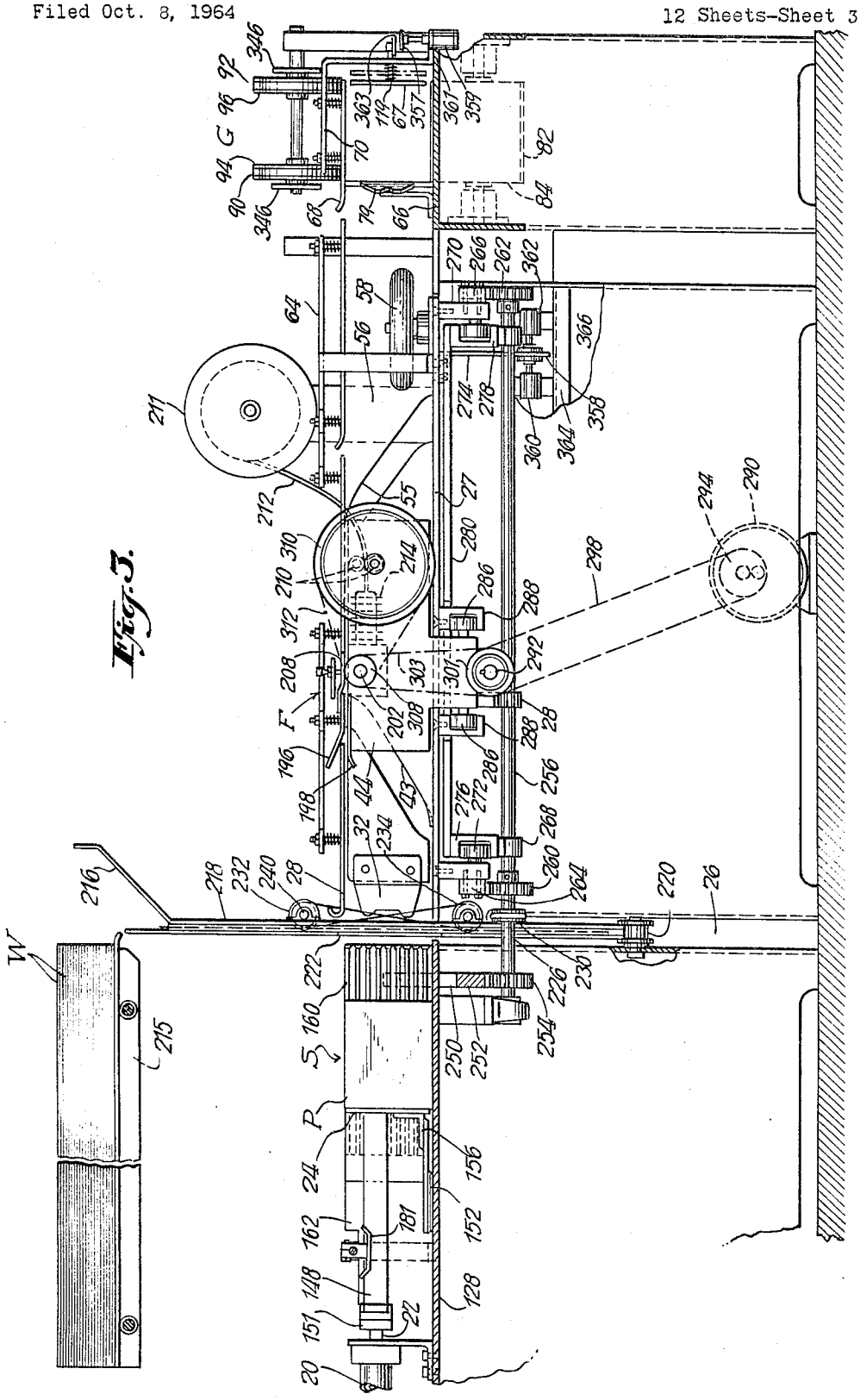


Fig. 3.

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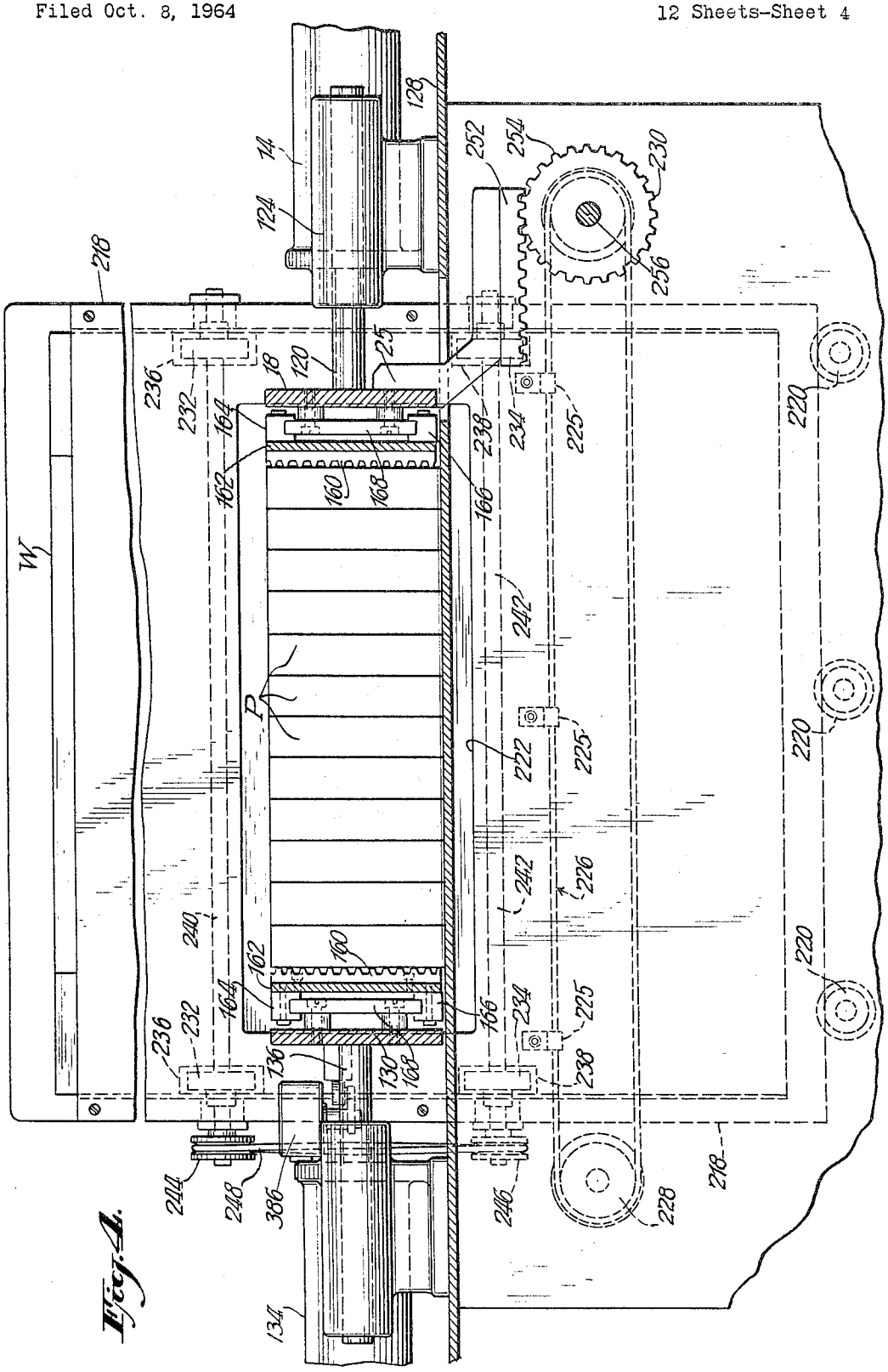


Fig. 4.

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WRAPPING MACHINE AND METHOD

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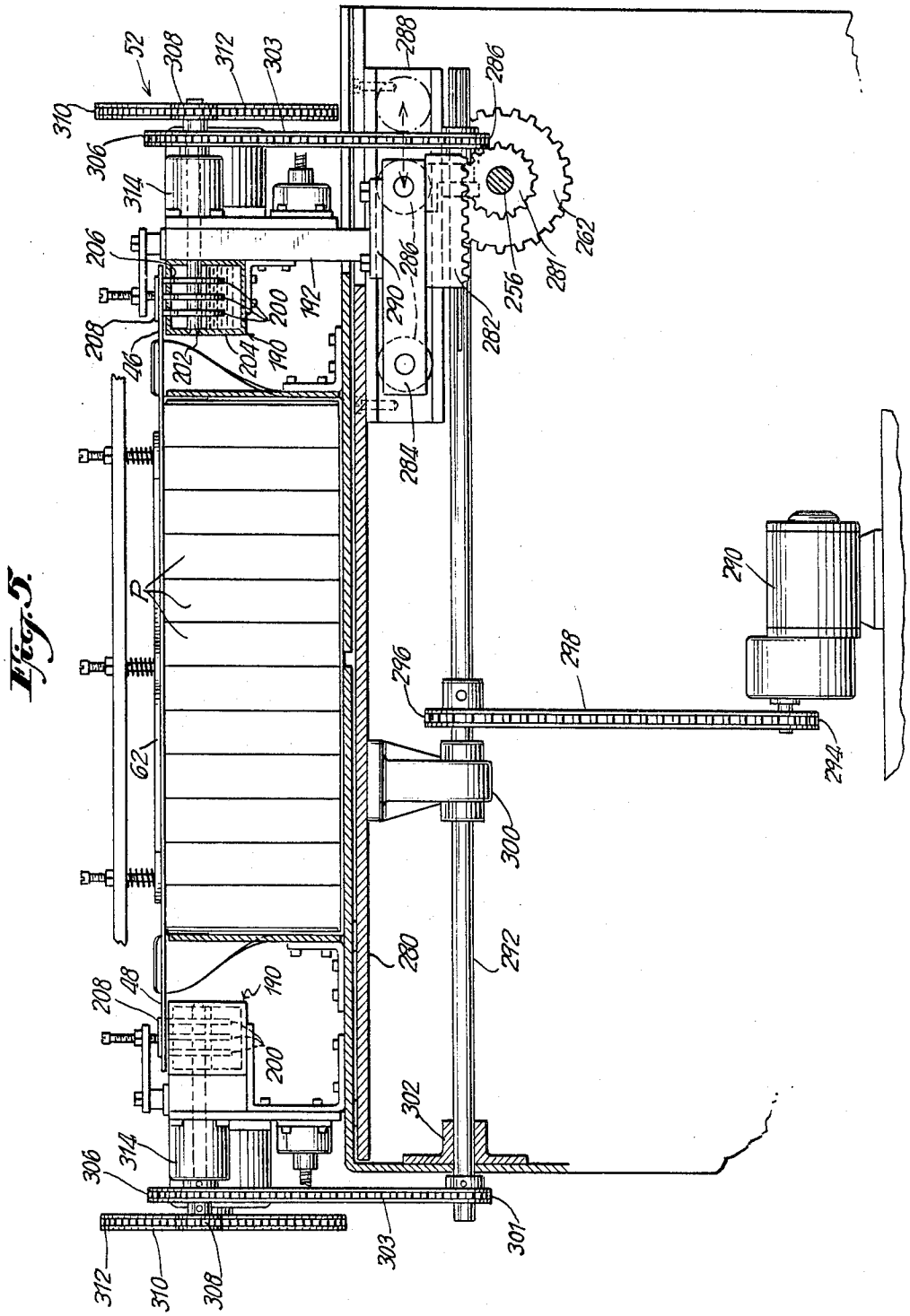


Fig. 5.

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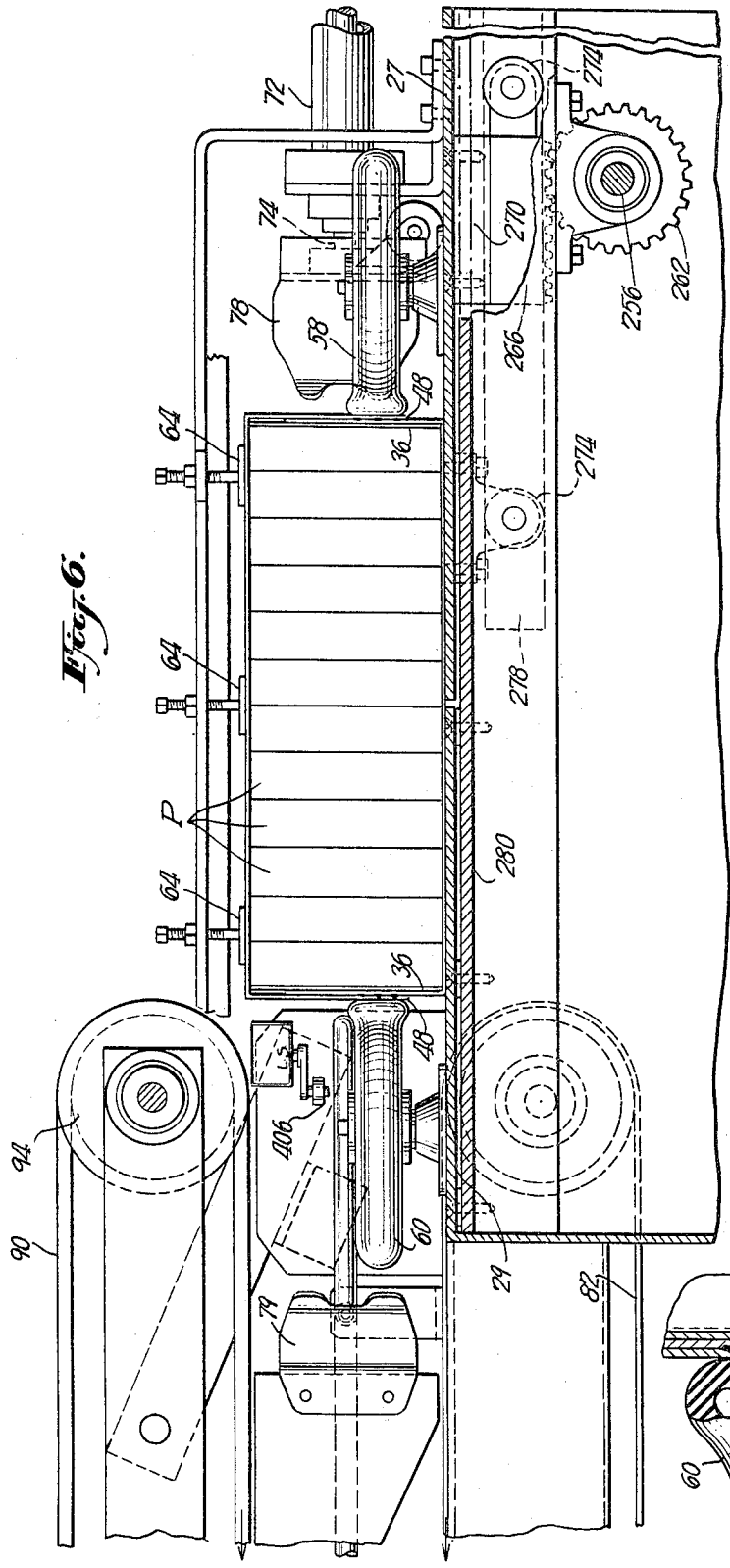


Fig. 6.

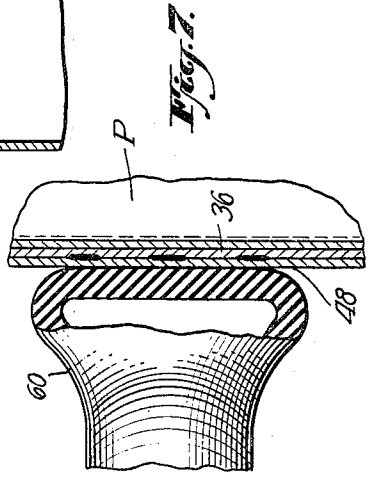


Fig. 7.

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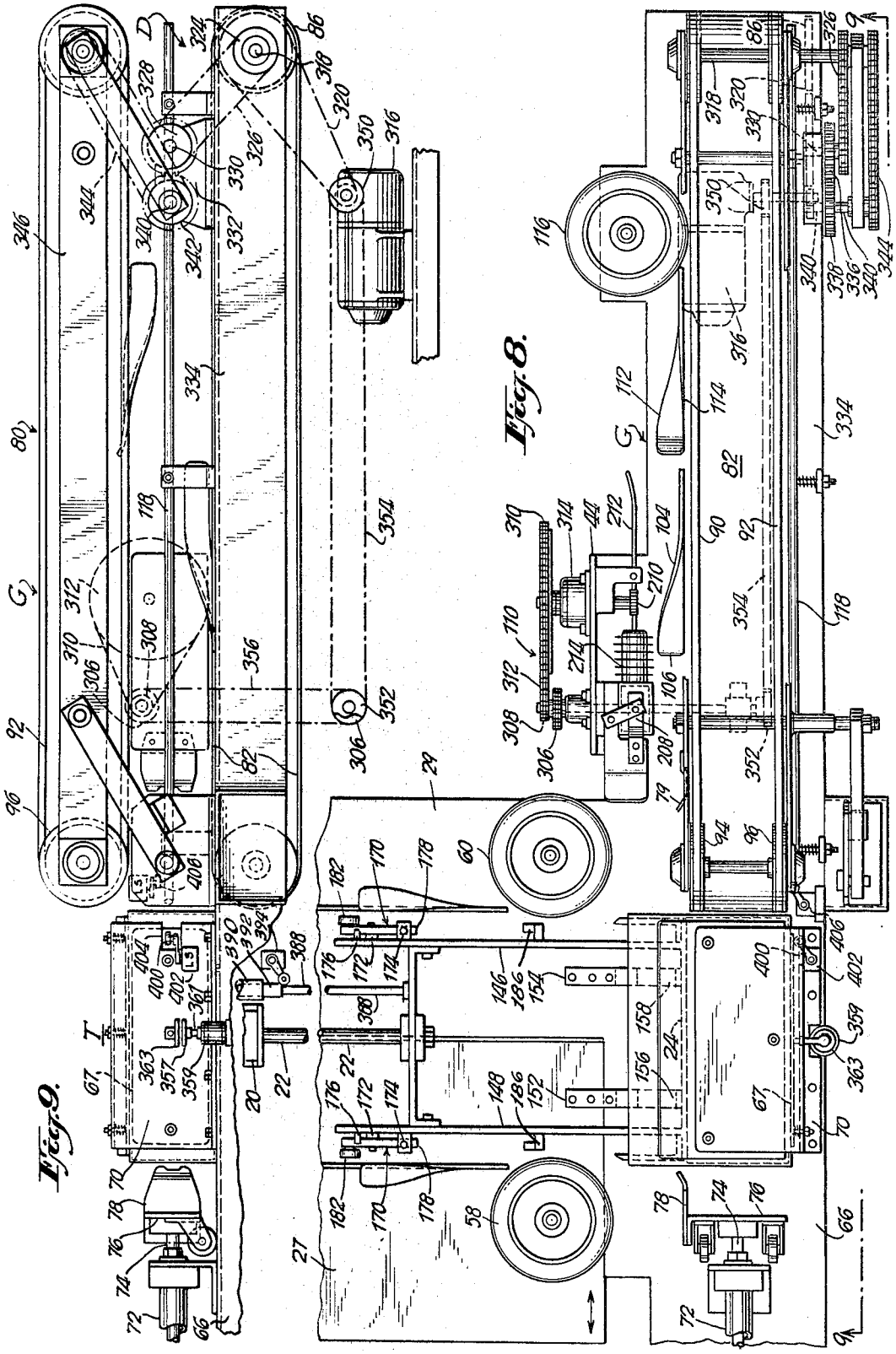


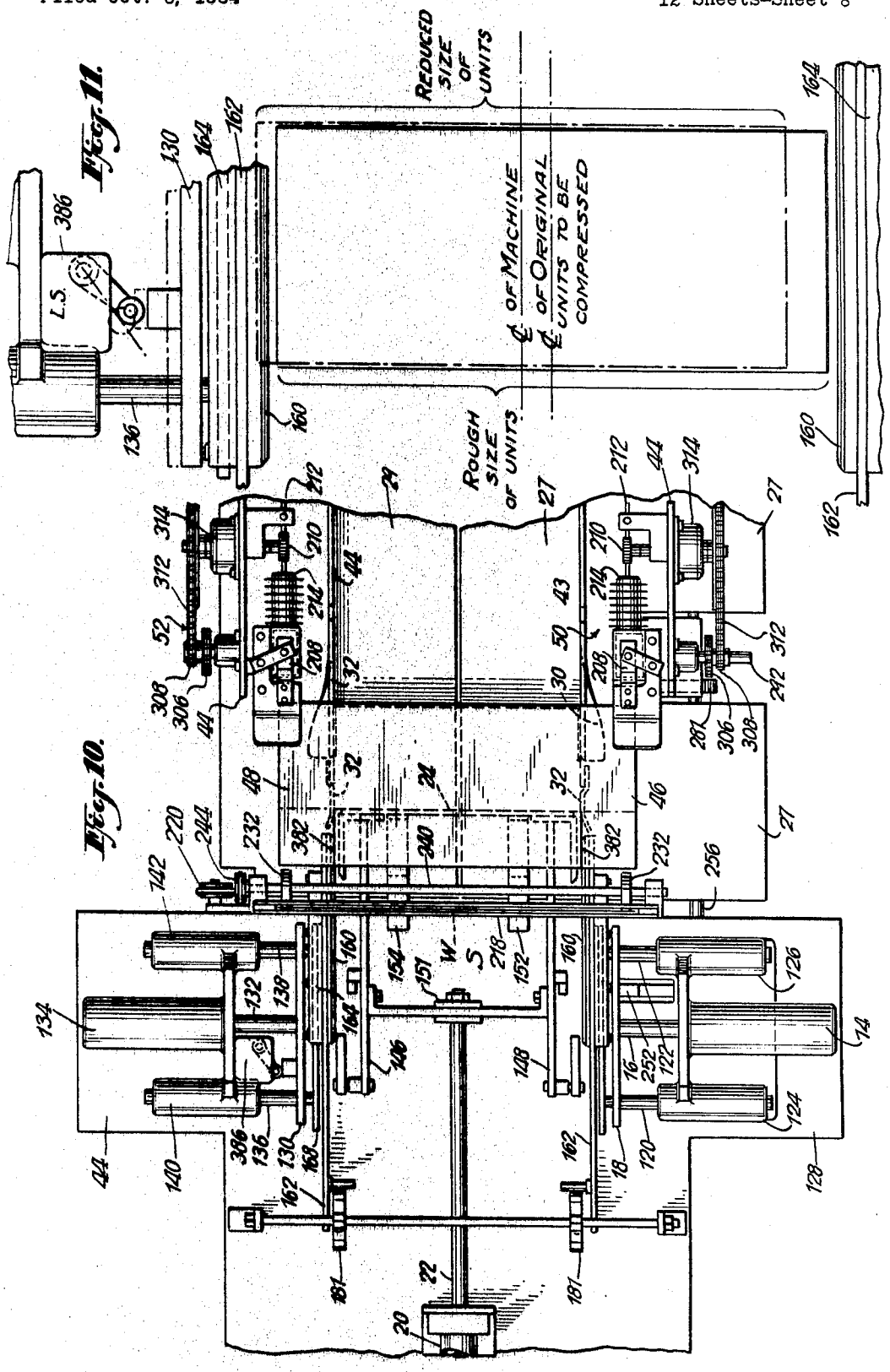
Fig. 8.

Fig. 9.

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Fig. 13B.

Fig. 12.

Fig. 13A.

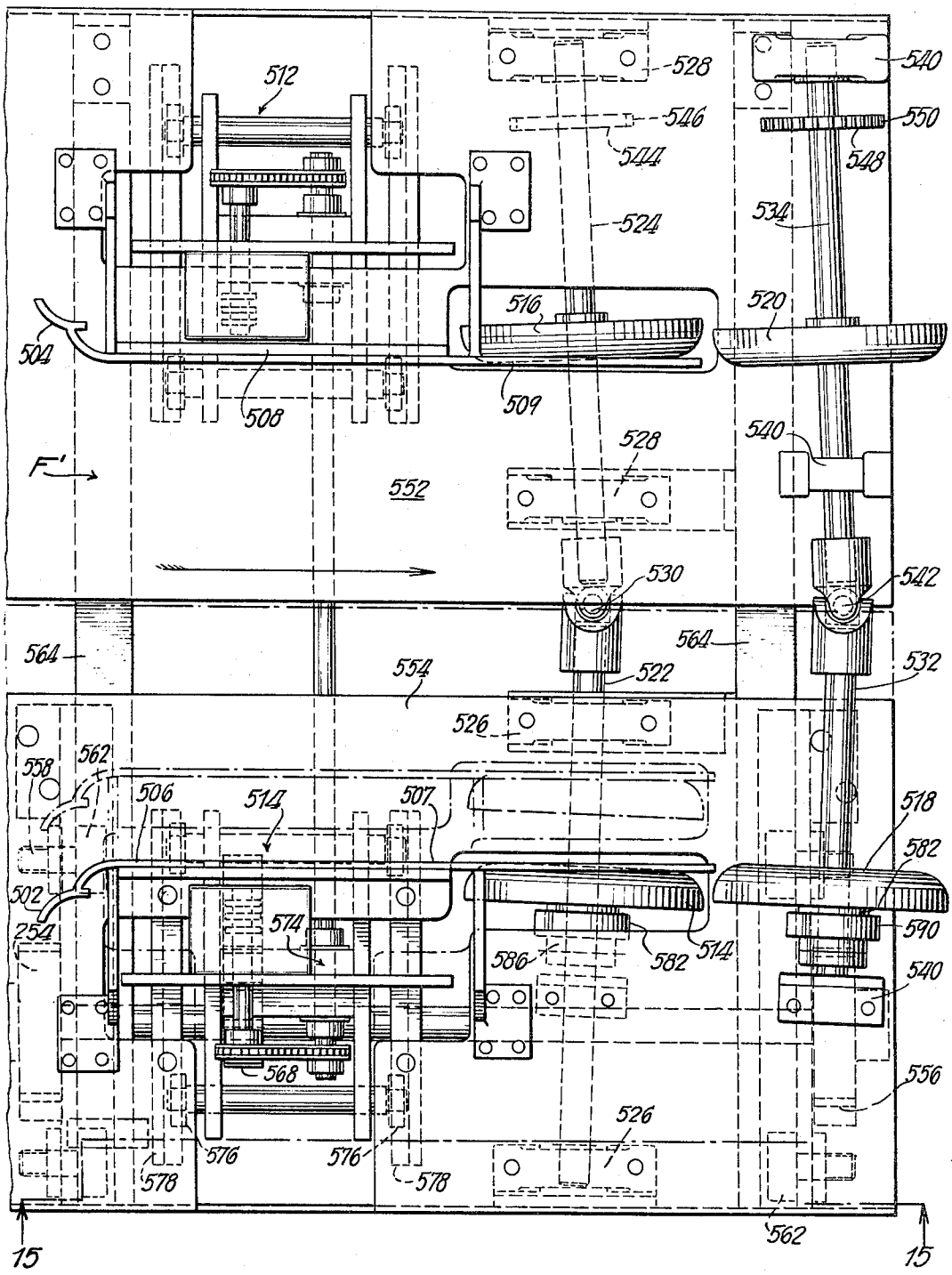
Fig. 13.

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Fig. 14.



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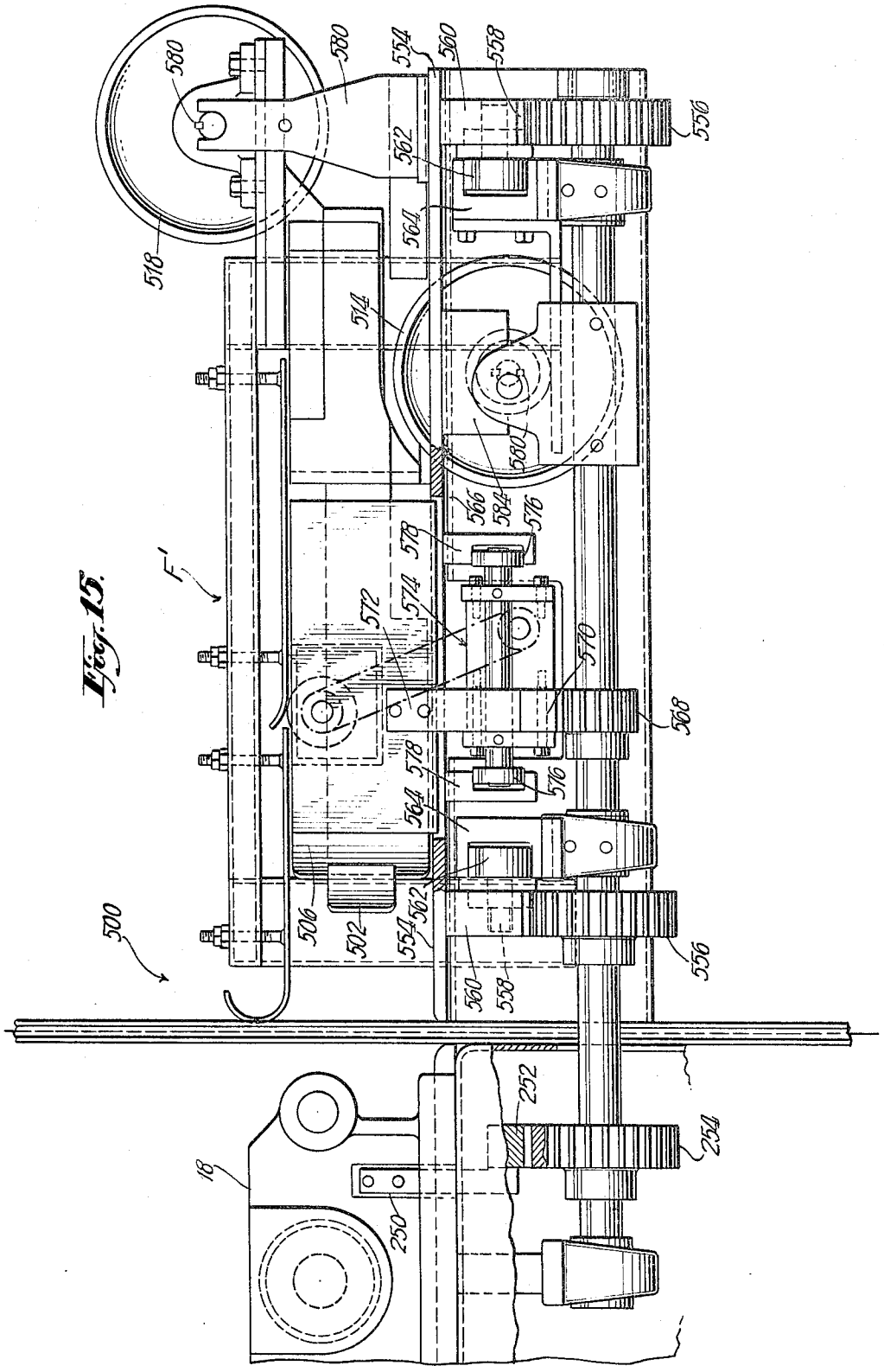


Fig. 15.

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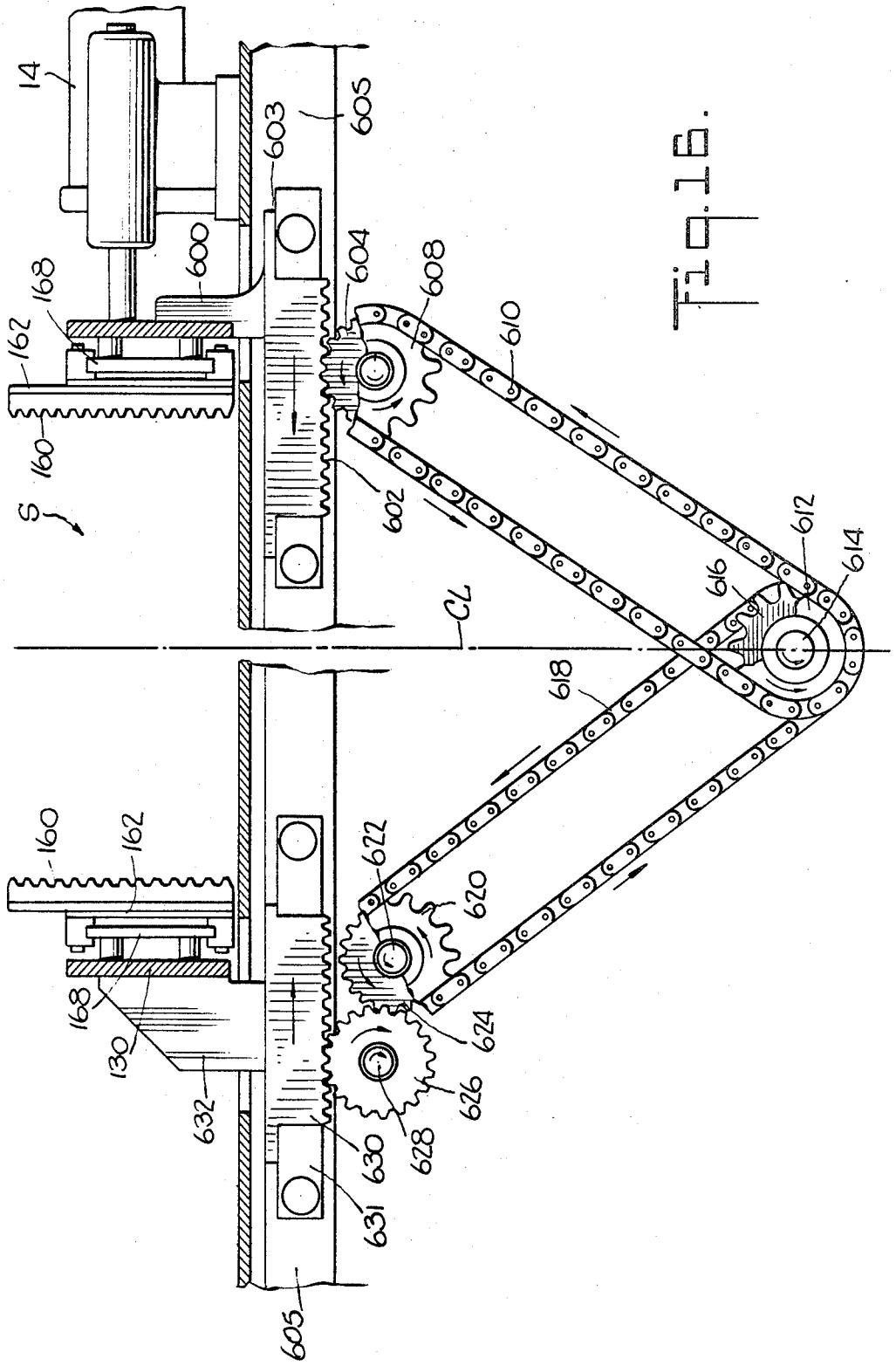


Fig. 16.

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3,383,825

WRAPPING MACHINE AND METHOD

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Filed Oct. 8, 1964, Ser. No. 402,483
11 Claims. (Cl. 53—24)

ABSTRACT OF THE DISCLOSURE

This invention relates to a wrapping machine and method for wrapping a plurality of individual items into a single, unitized package. In accordance with the present invention the individual items are initially compressed with a pre-determined compressive force and advanced against a sheet of flexible wrapping material and hence along a support past a plurality of wrapping and securing members, with the pre-determined compression of the individual units being maintained while the sheet of wrapping material is being wrapped and adhered thereabout to form a single wrapped package of said plurality of individual packages. Means are also provided for adjusting the position of the machine of the wrapping material and selected wrapping and securing members to compensate for variances in dimension between successively-wrapped packages.

The foregoing "Abstract of Invention" is solely for the purpose of enabling the Patent Office and the public generally to determine quickly from a cursory inspection the nature and guise of the technical disclosure, and the abstract shall not be used for interpreting the scope of the claims.

The present invention relates to packaging and more particularly to the single-ply packaging of a plurality of items by suitably applying a single-ply wrapping sheet tightly about the items to be packaged so as to form a novel tight-wrapped single-ply shipping container or package wherein the packaged items are formed into a self-supporting, cellular, unitized structure.

Heretofore, problems have been encountered in packaging together a plurality of items such as frozen food containers, flour or sugar packets and the like. It will be understood that for such items to be suitably wrapped by a sheet of flexible material for shipping, the items must be compressed together prior to wrapping to form a compact unit. Any play or looseness of adjacent packages results in damage to the package and/or its contents. However, items such as the frozen food containers tend to vary in dimensions depending upon the particular contents of the package. Accordingly, when a plurality of these frozen food containers are collected as is done conventionally prior to wrapping with an outer flexible wrapping sheet and they are then wrapped by conventional methods and apparatus, the results have proved unsatisfactory. This was due to the variation in dimension of the packages when collected and the fixed wrapping elements of the conventional wrapping machine which must be set to the largest probable package grouping which inevitably resulted in some play or looseness between adjacent containers in the wrapped package, resulting in substantial damage to the wrapped package and in contents in storage and shipping. Accordingly, frozen food containers are normally shipped in rigid corrugated-board containers even though this method of packaging is costly.

Similar problems are encountered with the wrapping of flour or sugar packets together for storage and shipping.

These items, because of the nature of the material, when compressed tend to take the shape of their particular container or bag. However, since flour, sugar and the like tend to settle differently package-to-package or batch-to-batch, attempts to tightly wrap and ship these items in flexible outer wraps, such as bags, have also been unsuccessful since, employing conventional wrapping methods and apparatus with its fixed wrapping elements, a tight outer wrap could not be achieved and the flour or sugar packets generally arrive at their destination with crushed or "dog-eared" corners, making for an unattractive store shelf appearance.

The present invention provides a solution to these problems. As described hereinabove, groups of frozen food packages as packed and frozen, may vary rather considerably in size and, of course, thus cannot be compressed without melting them, except to a very limited degree and yet it is desired to wrap them tightly in a finished package. Likewise, in packaging groups of small bags of flour or sugar and the like, due to different conditions and different degrees of settling, the group as a whole cannot very well be compressed to a pre-determined size and thus tightly wrapped.

The present invention provides the solution by providing mechanism to compress the items to be packaged to a variable dimension or sensed dimension corresponding to a pre-determined compressive force to form the items into a self-supporting cellular structure and maintaining the items in such self-supporting cellular structure while wrapping a single-ply sheet of flexible wrapping material such as paper thereabout. Likewise to form and wrap such sheet properly about the compressed items, the positions of the wrapping material and the wrapping and securing elements of the machine are also adjusted relative to the line of travel of the items in the wrapping machine in response to the sensed compressed dimension. Thus there is achieved, by means of the present invention, a novel, tightly-wrapped single-ply shipping container for items which have been formed into a self-supporting cellular unitized structure.

In accordance with one form of the present invention a plurality of packages are compressed "sideways" under a predetermined pressure between a cylinder-actuated pressure plate and a back-up plate. The pressure plate compresses the plurality of packages until it exerts a predetermined force on such packages. The amount of travel of such pressure plate, and thus the width of the wrapped package, will vary, of course, depending on the nature of the items being compresed. When this pre-determined force has been exerted by the pressure plate, a second cylinder-actuated pusher plate, disposed at right angles to the pressure plate, then is activated to push the group of compressed packages through the first section of the wrapping machine and against a vertically-suspended wrapping sheet, so that the sheet folds around the group in a generally U-shaped configuration. As the pusher plate continues to advance, the group of packages is advanced between suitable adhesive applying and flap-folding means, whereby flap portions of the wrapping sheet which extend outwardly on either side of the group are folding into sealing contact with the side walls thereof. Upon further advance of the pusher plate, the group of packages is adapted to be compressed lengthwise between the pusher plate and a back-up plate located at a transfer station. Upon completion of the lengthwise compression step, a transfer cylinder is actuated to push the partially-wrapped group of packages at right angles to their original path into the second wrapping section of the machine, whereupon suitable adhesive applying and flap folding means are adapted to fold the flap portions of the wrapper sheet which extend rearwardly of the

group, into sealing contact with the rear wall thereof to complete the package.

During the entire travel of the packages through the wrapping machine, the original compression of the packaged items is maintained. Thus, as the package passes through the folding and sealing portions of the machine, the packages pass between side members spaced apart the same distance as the compressed width of the packages. Likewise, the compressed packages pass beneath biased top members maintian compressive force on the packages in a vertical direction also, during wrapping thereof.

As described generally hereinabove, the present invention is further characterized by the provision of means for adjusting the position, in the wrapping machine, of the wrapping material and selected wrapping and securing elements relative to the line of travel of the items through the wrapping sections of the machine in response to the sensed or compressed dimension. Thus, in one of the forms of the machine of the present invention, structure is provided whereby the vertically-suspended wrapping sheet and certain of the adhesive-applying and flap-folding means, associated with first flap-sealing path described above, are adapted to be automatically positioned with respect to the particular sensed compresed width of the group of packages then being wrapped, thereby compensating for any variance in side dimension or width between successively-wrapped groups of packages. A suitable linkage, such as a rack and pinion, is employed to interconnect the pressure plate with the wrapping sheet trough or support, the adhesive-applying support means and the flap-folding support means to effect appropriate movement of these elements in response to the particular amount of movement of the pressure plate so that each completed package will be tightly wrapped with the wrapping material and have uniform and properly adhered side flaps.

Thus, in accordance with the present invention, the completed package comprises a novel shipping container of plurality of individual packages pre-compressed together to form a self-supporting, cellular, unitized structure and having tightly wrapped thereabout a sheet of single-ply flexible material. The novel container of the present invention is less costly than either corrugated board boxes or pre-formed bags and, in fact, due to the self-supporting unitized cellular configuration of the contents thereof, is more desirable since the contents thereof survive storage and shipping, arriving at their destination in better condition than heretofore.

Further objects and advantages of the invention will be obvious herefrom or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The foregoing general description and the following detailed description are exemplary and explanatory, but are not restrictive of the invention.

Of the drawings illustrating by way of example preferred embodiments of the invention and wherein like numerals designate like parts:

FIG. 1 is a perspective view of the machine of the present invention with portions thereof illustrated schematically;

FIG. 2 is a partial plan view of the machine of the present invention at the start of the wrapping operation;

FIG. 3 is a longitudinal sectional view taken along line 3—3, FIG. 2;

FIG. 4 is a cross sectional view taken along line 4—4, FIG. 2;

FIG. 5 is a cross sectional view taken along line 5—5, FIG. 2;

FIG. 6 is a cross sectional view taken along line 6—6, FIG. 2;

FIG. 7 is an enlarged sectional view illustrating the operation of the flap sealing means;

FIG. 8 is partial plan view of the machine of the present invention illustrating the section of the machine for completing the wrapping operation;

FIG. 9 is side elevational view of the mechanism shown in FIG. 8;

FIG. 10 is a partial plan view of the pressure applying means and associated mechanism;

FIG. 11 is an enlarged plan view of a portion of the compression station;

FIG. 12 is a perspective view of the successive steps in the wrapping operations of the machine of the present invention;

FIG. 13 is a plan view of a suitable wrapping sheet blank which may be employed with the present invention;

FIG. 13*a* is a side elevation of the partially-wrapped package, illustrating the side seal arrangement;

FIG. 13*b* is an end elevation of the completed package illustrating in the end seal arrangement;

FIG. 14 is plan view of the first wrapping section of a modified form of the mechanism of the present invention;

FIG. 15 is a side elevation, partially in section taken along line 15—15, FIG. 14;

FIG. 16 is an end sectional view similar to FIG. 4, and illustrating another modified form of the mechanism of the present invention.

General description

Referring to FIGS. 1–3, a plurality of packages designated P which may be, for example, sugar or flour packets, frozen food containers, or the like, are positioned on a support plate **12** at a receiving station S of the wrapping machine, designated generally **10**.

With packages P positioned at station S as shown in FIG. 1, the operator actuates a suitable switch (not shown), energizing double-acting air cylinder **14**, extending piston rod **16** thereof. The free end of rod **16** is provided with a compression plate **18** adapted to being a compressive force to bear against the end of the row of packages P when cylinder **14** is actuated (see FIG. 1).

To achieve the desired compressive force on packets P, the air pressure to cylinder **14** is regulated to a selected figure; such as 70 p.s.i. Knowing the size of cylinder **14** and the pressure actuating it, it can be readily determined the amount of compressive force being brought to bear by plate **18** on the packets P. It will be understood that with the air pressure regulated to the selected figure, in each instance, plate **18** exerts the same force on packets P at station S as described in detail hereinbelow. However, the distance travelled by plate **18** will depend on the nature of the particular material in packets P. Thus, in order to exert the selected compressive force, plate **18** will have to travel further against packets P when the contents thereof are readily compressible than will be the case when the contents of packets P are less readily compressible.

With packets P thus compressed with the desired force, a second double-acting air cylinder **20** is actuated by the operator extending its piston rod **22**. The free end of rod **22** is, in turn, provided with a pusher plate **24** which, when cylinder **20** is actuated, pushes or advances the row of compressed packets P in the direction of arrow A, FIG. 1, out of the receiving zone S and against a sheet or blank or wrapping material W, which is preferably a single-ply paper sheet, disposed vertically in the path of travel of packets P with a portion of sheet W disposed beneath support **12** in an opening **26** between station S and the first wrapping section F of machine **10**. The continued extension of rod **22**, advances the row of packets P against the sheet of wrapping material W and into the first wrapping section F of the machine **10**.

As packets P are advanced by rod **22** into wrapping section F, sheet W is draped about packets P into a generally U-shaped configuration by passage between a pair of spaced support plates **27**, **29** in section F and an upper spring-biased compression plate **28**. With blank or sheet

W thus draped about packets P in a generally U-shaped configuration, the packets are advanced by rod 22 along plates 27, 29 into and through the first wrapping section F.

As partially-wrapped packets P are moved into section F, the row of packets P are moved between a pair of spaced plows 30 and 32 folding the end flaps 34 and 36 of blank W against their respective sides of the row of packets P.

The continued advance of the row of partially-wrapped packets P through wrapping section F accomplished the enclosing of packets P on five sides. As the row of packets moved past plows 30, 32, the bottom flaps 38 and 40 of blank W are folded upwardly against tucked-in end flaps 34 and 36 respectively. This is accomplished, in this particular embodiment, by passage of flaps 38 and 40 upwardly along the inclined cam faces 41 and 43 of their associated plows 42 and 44 respectively as packets P are advanced by rod 22 through section F (see FIGS. 1 and 3).

As flaps 38 and 40 are being folded against end flap 34, the top flaps 46 and 48 of blank W have adhesive applied to their respective underfaces by passage with packets P through the zone of operation of their respective adhesive-applying devices 50 and 52.

The final closure of packets P in section F is accomplished by folding downwardly of flaps 46 and 48 and securing them against previously-folded end flaps 38 and 40 respectively.

In the embodiment of FIGS. 1 to 11, this is accomplished by passage of flaps 46 and 48 downwardly along the inclined cam faces 53 and 55 of their associated plows 54 and 56 respectively as packets P are moved therepast. Folded-down flaps 46 and 48 are then travelled past associated rotatable pressure members 58 and 60 which are adapted to apply sealing pressure against the adhesive zone on flaps 46 and 48. Members 58 and 60 as shown in FIG. 1 are freely rotatable and are rotated by contact with packets P moving therepast to apply sealing pressure against the adhesive zone on flaps 46 and 48. However, if desired, members 58 and 60 could be positively driven from one of the machine drive systems described hereinbelow for positive contact between members 58 and 60 and their associated flaps 46 and 48.

As will be noted best in FIG. 1, as packets P are travelled through section F they pass beneath top pressure plate 28, second top pressure plate 62 aligned with plate 28 and a plurality of top pressure elements 64, all of which are spring-biased to exert a vertical compressive force on packets in section F, thereby ensuring a proper, tightly-wrapped package.

In order to ensure a proper, tight wrap of blank W about compressed packages P, the wrapping and adhesive-applying members of the embodiment of FIG. 1, associated with support plate 27, are movably mounted relative to their opposite number in section F as described hereinbelow. These members move in response to the inward movement of plate 18 to properly align such members to tightly wrap blank W about the packages P moving therepast. In like manner, the blank supporting means, described in detail hereinafter, also is movable in response to the movement of plate 18 to proper position blank W for tight wrapping about packages P.

As rod 22 reaches the limit of its travel, packets P are advanced thereby to transfer station T for transfer to the second wrapping section G of machine 10 disposed generally transverse to section F.

At station T, packets P are positioned on a stationary support table 66 against a resiliently-mounted wall 67 and beneath a spring-biased cover plate 68 supported by stop plate bracket 70 on table 66. Rod 22 is operative to compress packages P against wall 67 prior to its retraction into cylinder 20.

When rod 22 has been retracted by cylinder 20, cylinder 72 is actuated to extend rod 74 thereof, moving packets P from transfer station T into wrapping section G. As rod 74 is extended, plate 76 mounted on the free end thereof is adapted to engage the end of partially-enclosed package P at the side thereof formed by folded flaps 38 and 40 as described heretofore and move packets P into section G.

Simultaneously with the engagement of the packets P by plate 76, a plow element 78 thereon folds the overlapped portions of flaps 38 and 46 which extend beyond the end of packets P into position against the unenclosed portion of these packets. In like manner, as the packets are moved into section G by rod 74, the overlapped portions of flaps 40 and 48 which extend beyond the ends of packets P are folded thereagainst by movement past plow 79 disposed in the path of travel thereof as the packets P are advanced therepast into wrapping section G.

Packets P, upon entry into section G by transfer rod 74, are moved thereby into conveyor system, designated generally 80, which in the embodiment shown in FIG. 1 included a lower endless belt 82, adapted to travel about spaced pulley rollers 84, 86. Conveyor system 80 also includes an upper pair of spaced endless belts 90, 92 adapted to travel about upper pulleys 94, 96 and 98, 100 respectively. Belts 82, 90 and 92 are adapted to cooperate in advancing packets P through wrapping section G wherein the final wraps are made in blank W and from whence the completed package is delivered.

Upon engagement of packets P by conveyor system 80, the packets P are advanced thereby through section G in the direction of arrow B, FIG. 1, which is transverse to their direction of travel through section F.

As packets P are advanced through section G, lower end flap 102 of blank W is folded upwardly against packets P by plow 104 disposed in the path of travel of end flap 102 and provided with an inclined cam surface 106 for upwardly folding flap 102 against packets P. (See FIGS. 8 and 9.)

Simultaneously with the upward folding of bottom end flap 102, top end flap 108 has adhesive applied to the underface thereof by passage past adhesive-applying device 110. Continued advance of packets P through section G brings top end flap 108 into engagement with plow element 112 disposed in the path of travel thereof. Cam surface 114 of plow 112 is operative to fold top end flap 108 downwardly into overlaying relationship with bottom end flap 102 against the ends of packets P, thus completing the enclosure of the compressed packets P by blank W.

To ensure adhesion of top end flap 108, the overlying end flaps 102 and 108 are travelled past an associated rotatable pressure member 116 which may be similar in construction and operation to members 58 and 60 in section F and which is adapted to apply sealing pressure against the adhesive zone on flap 108. This completes the formation of the tightly-wrapped finished package 8 which is delivered to delivery station D in section G by conveyor system.

It will be understood that during their travel through section G, also, the compressive force on packets P have been maintained by confining the packets P between plow elements 104 and 112 and spring-biased wall 118 spaced therefrom while spaced conveyor belts 82, 90 and 92 maintain vertical pressure on the packets P.

Thus, the finished package 8 comprises a plurality of self-supporting packets P pre-compressed into a cellular, unitized structure and covered by a tightly-wrapped, single-ply sheet of wrapping material W, suitably folded and adhered thereabout.

Compression, pusher and bridging mechanisms

As described generally hereinabove, packages P at station S are compressed with a predetermined force by means of a pressure plate 18. Plate 18 is mounted for movement on the end of rod 16 of master cylinder 14 and supported by a pair of spaced support shafts 120

and 122 mounted in bearings 124 and 126 respectively on plate 128 of the main machine frame.

Cooperating with pressure plate 18 on the other side of station S is a back-up plate 130 adapted to provide the stationary force against which movable plate 18 compresses packages P. Back-up plate 130 is also mounted on the free end of a piston rod 132 of an air-actuated cylinder 134. Plate 130 is additionally supported by a pair of spaced support shafts 136 and 138 mounted in bearings 140 and 142 respectively on plate 144 of the main machine frame. Air cylinder 134 is normally-actuated by air under pressure to about the selected pressure to be used in actuating cylinder 14. Thus, back-up plate 130 exerts an almost equal and opposite resistance force to plate 18 ensuring proper compression of the packages P when cylinder 14 is actuated. However, in each instance the pressure to cylinder 134 should be less than the pressure to cylinder 14, for reasons set forth hereinbelow.

As shown best in FIG. 2, pusher plate 24 is connected to the free end of rod 22 by a pair of spaced elongated mounting members 146 and 148 which in turn are each connected to a cross-bracket 150 fixed to the free end of rod 22 as at 151. This extension of rod 22 moves plate 24 in the direction of arrow A to advance the compressed packets P from station S into and through section F of machine 10.

Preferably, plate 24 is mounted slightly above plate 12 and there is included in the supporting means for plate 24 a pair of spaced sliding shoe members such as nylon shoes 152 and 154 fixed to the rear face 155 of plate 24 by brackets 156 and 158 respectively. Shoes 152 and 154 are in sliding contact with plate 12 and plates 27 and 29 respectively during the movement of plate 24 through section F by rod 22 thereby facilitating such movement.

To maintain the compression on packets P during the travel thereof from station S into confinement between plows 30, 32 bridging means are provided to confine packets P and they are advanced by pusher plate 24 past blank W and into section F of machine 10. This bridging means includes a pair of bearing plates 160 each of which is fixed to an associated mounting plate 162. Mounting plates 162 are each provided with a pair of spaced keyways 164, 166 adapted for sliding travel along the upper end lower edges respectively of an associated key plate 168. One key plate 168 in turn is fixed to plate 18 while the other key plate 168 is fixed to plate 130 as shown best in FIG. 4.

It will be understood that as rod 16 is extended plates 18 and 130 exert the desired compressive force on packages P through bearing plates 160 which are in actual contact with the packages P.

Bearing plates 160 are adapted to move with packets P until said packages are moved between plows 30 and 32. To accomplish such movement of plate 160, members 146 and 148 adjacent the ends thereof remote from plate 24 each have mounted thereon a bridge actuating arm 170 pivotally mounted to its associated member 146 or 148 on a stud pin 172 positioned adjacent the mid-point of arm 170. A spring member 174 urges its associated arm 170 into position against a stop pin 176 on associated member 146 or 148.

In operation, as pusher plate 24 and its related mechanisms are advanced by extension of rod 22, the end 178 of each arm 170 is adapted to engage an associated catch 180 on their respective plate 162. As rod 22 continues to extend, each arm 170 urges its associated engaged catch 180 and plate 162 in like direction, sliding plate 162 and bearing plates 160 along their associated key plates 168, thus maintaining confinement therebetween packages P.

When packages P reach plows 30, 32, it is necessary to interrupt further advance of plates 160 along therewith. To accomplish this, each arm 170 is provided at the end thereof remote from end 178 with a roller element 182. When plates 160 reach their limit of desired travel with packages P, rollers 182 are adapted to engage a trip 181 on cross-bracket 184 disposed above members 146 and 148 and in the path of travel of rollers 182. Engagement of rollers 182 with trip 181 on cross-bracket 184 operates to pivot arms 170 about pins 172 and against the action of springs 174. This raises end 178 of each arm 170 out of contact with its associated catch 180, thereby disengaging plates 160 from further advance with pusher plate 24. (See FIGS. 2 and 9.)

When rod 22 is retracted as described hereinbelow, plates 160 are returned to operative position at station S by engagement between one of the extensions 186 on each member 146, 148, and an associated catch 188 on each plate 162.

Adhesive applicator

The adhesive-applying devices 50, 52 and 110 referred to hereinabove are substantially identical in construction and operation except as noted hereinbelow. Accordingly in the interests of brevity only one such device; namely applicator 50, shall be described herein in detail with like parts thereof in devices 52 and 110 bearing like reference numerals in the drawings.

Device 50 includes an adhesive reservoir 190 mounted on a support bracket 192 mounted as described hereinbelow, it being understood that bracket 192 of device 52 is mounted on plate 29 while bracket 192 of device 110 is mounted on a support plate 194 of an extension of the main machine frame.

Each adhesive applying device as shown in FIG. 2 includes a pair of upper and lower flap guides 196, 198 which directed the flap to which adhesive is to be applied into the zone of adhesive application as packages P are advanced therepast. To apply the adhesive to the particular flap, there is mounted in each reservoir 190, an adhesive applying member which as illustrated in FIG. 5 may include a plurality of rotatable applicator members 200 mounted on a drive shaft 202 for travel into and out of the adhesive pool 204 in reservoir 190. Members 200 extend through an accommodating opening 206 in the top of reservoir 190 to contact the underface of a flap of blank W moving therepast. In order to ensure proper contact between the flap and rollers 200, an adjustable spring element 208 is adapted to resiliently bear against the side of the flap remote from rollers 200, thereby facilitating the proper application of adhesive thereto by members 200.

Devices 50, 52 and 110 also include an adhesive feed and heating unit which comprises a pair of opposed adhesive feeding rollers 210 between which the strip 212 of adhesive is disposed, the adhesive being stored in strip form on a suitable supply roll 211 mounted on the machine frame. Rollers 210 are mounted on associated bracket 192 and driven along with rollers 200 as described hereinbelow to feed the strip of adhesive into reservoir 190. Before the strip 212 passes into reservoir 190 it is fed by rollers 210 into heater unit 214 which melts strips 212 into liquid form in which form it is contained in reservoir 190 for application by rollers 200 to the particular flap of blank W.

Suitable hot-melt strips adhesive for use with the adhesive-applying devices hereinabove described may be obtained commercially from the B. B. Chemical Division of United Shoe Machinery Corporation, Cambridge, Mass., under the trade designation "Thermogrip."

It will be understood that other fast-setting thermoplastic adhesives and applicators may be employed to apply adhesive suitably to the flaps of blank W. Likewise, blanks having thereon a pre-applied adhesive pattern may be used with the present invention without adverse effect. In such case, devices 50, 52 and 110 are replaced by suitable devices such as heaters, for properly activating the particular adhesive applied to blank W.

Blank mounting and support means

Blanks W are preferably individually fed by the machine operator for a storage rack **215**. The sheets are individually fed into a receiving trough **216** and thence into a carrier frame **218** disposed in the path of travel of packages P as they advance from station S into wrapping section F. As shown best in FIGS. 3, 4, frame **218** is positioned in the accommodating opening **26** between table **12** and support plates **27, 29**. Frame **218** is provided with an appropriate opening or window **222** therein to permit passage therethrough of the compressed packages P and against blank W. Frame **218** is supported at its lowermost end on spaced rollers **220** in the machine **10** and secured to the upper stretch **224** of an endless cross-cable **226** by means of brackets **225**. Cable **226**, in turn, is supported at each end of a pulley **228** and **230**. Cable **226** is fixed to pulley **230** so that rotation of pulley **230** travels the upper stretch **224** of cable **226** back or forth, thereby moving frame **218** on rollers laterally in opening **26** for reasons hereinabove set forth.

Preferably, frame **218** and blank W are so dimensioned that equal portions of blank W are disposed above and below window **222**. This ensures that when blank W is draped about package P advanced therepast by rod **22**, an even U-shape fold is made thereabout with end flaps **102** and **108** substantially coterminous. To accomplish this frame **218** is provided with a pair of upper and lower rollers **232** and **234** mounted in suitable bearing in accomodating opening **236** and **238** respectively for engagement with a blank W in frame **218**.

Upper rollers **232** are connected together by means of cross-shaft **240** which lower rollers **234** are joined together for common rotation by cross-shaft **242**. Shafts **240** and **242** are provided at one end thereof with a suitable sheave **244** and **246** respectively interconnected by cross-drive belt **248**. In operation, as blank W is being draped about packages P as they advance through window **222** into section F, the blank W rotates upper and lower roller **232** and **234** in contact therewith. Since rollers **232** and **234** are in driving interconnection by means of sheaves **244** and **246** and belt **248**, these rollers are rotated in synchronism to ensure uniform feed-out of blank W through window **222** and about packages P.

Preferably, the tension in belt **248** is suitably adjusted such that rollers **232** and **234** apply some braking or tension force equally on the ends of the blank W as it is fed out to ensure a tight disposition of blank W about the packages. If desired other suitable braking means may be employed without adverse effect.

Supporting and operating means for movable folding and adhesive-applying members

As described hereinabove, certain of the wrapping and adhering elements are movably mounted for movement toward their opposite number in response to the movement of plate **18** in compressing packages P at station S.

To accomplish this, there is fixed to a bracket **250** downwardly depending therefrom as shown in FIG. 4. Bracket **250** includes a rack section **252** having teeth **254** in meshing engagement with a cooperating pinion gear **254** mounted on and rotatable with main drive shaft **256** supported in suitable bearings **258** on the machine frame. (See FIG. 3.)

To adjust the position of plow **30, 43, 54** and pressure roller **58**, all of which are supported on table **27**, shaft **256** is provided with additional pinions **260** and **262** which are in meshing engagement with related rack sections **264** and **266** respectively secured to brackets **268** and **270** depending from the underface of table **27**. Brackets **268** and **270** are each provided roller elements **272** and **274** respectively adapted to travel in an associated channel-shaped member **276** and **278** secured to an underplate **280** of the machine frame to which plate **29** is secured (see FIG. 6).

In operation, as bracket **250** is travelled inwardly against the side of packages P at station S during the compression operation with plate **18**, pinion **254** in meshing engagement with rack section **252** thereof, rotates shaft **256** an amount corresponding to the inward movement of plate **18**. Since pinions **260** and **262** are also fixed to shaft **256**, these members are rotated a corresponding amount in like manner. However, this rotation of pinions **260** and **262** effects travel of their associated brackets **268** and **270** in their related channels **276** and **278** thereby moving plate **27** secured thereto and plows **30, 43, 54** and pressure roller **58** mounted thereon, a like distance toward their opposite numbers. It will be understood that upon interruption of movement of plate **18**, movement of these members is likewise interrupted. In the embodiment of FIGS. 1–11, it has been found preferable to move only one such set of wrapping elements. Thus, pinions **260** and **262** are equal in diameter and number of teeth to pinion **254** while racks **252, 264** and **266** of like construction to move their related elements a distance equal to the distance moved by plate **18** during the compression of packages P.

Turning to FIG. 5, there is illustrated the means for adjusting the position of adhesive-applying device **50**. This means includes another pinion gear **281** mounted on shaft **256**. Gear **281** in turn is in meshing engagement with a rack member **282** secured to a bracket **284** provided with rollers **286** for lateral movement in channel-shaped bracket **288** secured to underplate **280** with support **192** of device **50** mounted on a plate **290** carried by bracket **284**. Thus, when shaft **254** is rotated as plate **18** compresses packages P, pinion **281** is also rotated travelling bracket **284** in channel **288**, moving adhesive-applying device **50** toward its opposite member **52**. However, since the adhesive is preferably applied the same distance in from the edge of flaps **46** by device **50**, pinion **281** is only one-half the diameter of the other pinion gears so as to move device **50** only one-half the distance that the folding and securing elements are moved.

Further, as described hereinabove, frame **218** is provided with brakets **225** secured to cable **226** which in turn is fixed to pulley **230**. As shown best in FIG. 4, pulley **230** is secured to and is rotatable with shaft **254**. Thus, as the shaft **254** is rotated as described heretofore, pulley **230** is likewise rotated moving cable **226** laterally to adjust the position of frame **218** in opening **26**. Again, since it is desirable to form equal width side flaps, pulley **230** is one-half the diameter of pinion **252** so that frame **218** moves only one-half the distance that the folding and securing elements move.

Machine drive means

The drive means of the present invention includes in the first wrapping section F, a suitable source of power such as electric motor **290** in driving connection with a cross-shaft **292** by means of sprockets **294, 296** and chain **298**. Shaft **292** is carried by a bearing hub **300** fixed to the underface of plate **280** as shown in FIG. 5 and carried in suitable bearings **302** at each end of shaft **292** secured to the main machine frame (see FIG. 5).

Secured to each free end of shaft **292** is a sprocket **301** respectively in driving engagement with a sprocket **306** on the shaft **202** of roller elements **200** of its associated adhesive-applying device **50** or **52** by means of chain **303**.

To rotate glue feed roll **210**, shaft **202** is provided with a second sprocket **308** in driving connection by means of chain **310** with a sprocket **312** on the input shaft of electric clutch **314** upon whose output shaft is mounted one of the feed roll **210**. Thus, actuation of the electric motor **290**, glue strip **212** is fed into its associated heater unit **214** at reservoir **190** as described hereinbelow while applicator elements **200** are rotated in reservoir for appreciation of adhesive to a flap moving therepast.

In section G, there is provided a second source of power, such as motor **316**, in driving engagement with means of chain **320** a cross-shaft **318** supported in suitable bearings in the machine frame. Shaft **318** is secured to pulley roller **86** of belt **82**, thereby connecting motor **316** in driving engagement with belt **82**.

In like manner, motor **316** drives upper belts **90** and **92**. Shaft **318** includes another sprocket **324** thereon about which travels one end of a chain **326**. The other end of chain **326** is disposed about a sprocket **328** on shaft **330** rotatably carried by bracket **332** on support plate **334** of the machine frame upon which end wall **67** is secured. Shaft **330** also includes a gear element **336** in meshing engagement with a gear element **338** on a second shaft **340** rotatably carried by bracket **332**. Shaft **340** in turn includes a sheave **342** thereon about travels one end of a belt **344**, the other end of belt **344** disposed about pulley **346** on shaft **348** to which upper belt pulleys **98** and **100** are secured. Thus motor **316** is operative to drive conveyor system **80** to deliver packages P in section G to delivery station D.

In like manner, motor **316** is in driving connection with adhesive applying device **110** by means of single sprocket **350**, double sprocket **352** and chains **354** and **356** with chain **356** adapted to drive sprockets **306** and **308** of device **110** as described heretofore in connection with devices **50** and **52**.

Brake means

It will be understood that as compressed packages P move into wrapping section F and into confinement between the opposed plow elements thereof, packages P tend to exert a reactive force against these confining elements. Therefore, since certain of the plow elements are movably mounted, it is necessary to provide means on the movable members for resisting such reactive force. This means includes a bracket **358**, depending downwardly from movable plate **27**. A pair of opposed air cylinders **360** at **362** mounted on cross-members **364** and **366** of the machine frame are each adapted upon actuation just prior to entry of packages P into section F to engage bracket **358**, holding bracket **358** and its associated plate **27** and movable plow elements in position during the wrapping operation of the machine in section F.

In like manner, wall **67** is locked in position as packages P are urged thereagainst to prevent rebound thereof by the springs **119**. To accomplish this, air cylinder **359** is provided having a braking disk **357** on the free end of its piston rod **361** adapted to frictionally engage a cooperation disk **363** on wall support **365** when cylinder **359** is actuated thereby locking mounting frame **118** of wall **67** in position, preventing backward movement of wall **67**.

Blank

Blank W is preferably formed as shown in FIG. 13, with three main panels **368**, **370** and **372** in addition to side flaps **34**, **36**, **38**, **40**, **46** and **48**, end flaps **102** and **108**, said main panels, side flaps and end flaps being separated by imaginary lines along which the blank will be subsequently folded during the forming of the completed package **8** as described hereinabove.

To facilitate folding and to achieve the desired side seals as shown in FIG. 13*a*, blank W is additionally provided with side slits **374** and **376**. As shown, slits **374** and **376** are spaced from adjacent line **371** within the confines of their associated side panels **48** and **46** respectively. In this manner, the desired side seal arrangement (FIG. 13*a*) is achieved.

In like manner, end flap **108** is provided with spaced slits **382** to facilitate folding and to achieve the desired end seal shown in FIG. 13*b*. As shown, slits **382** are spaced from their adjacent lines **371** within the confines of end flap **108**. In this manner, the desired end seal arrangement (FIG. 13*b*) is achieved.

As shown best in FIGS. 13*a* and 13*b*, the completed package is provided with side seals (see FIG. 13*a*) and an end seal (see FIG. 13*b*) wherein the particular flap is adhered to at least two other underlying flaps, thereby increasing the strength of such seal.

If desired, one of the main panels such as panel **368** may be provided with a perforated tear line **385** to facilitate opening of the completed package **8**.

Machine controls and sequence of operation

As described hereinabove, cylinder **14** is manually actuated at the start of the wrapping cycle to compress packages P at station S. Back-up plate **130** is adapted to exert an opposite but somewhat smaller force than that of compression plate **18**. As the maximum selected pressure to be exerted is reached, the pressure force actuating plate **130** will be exceeded forcing plate **130** slightly backward. This slight movement of plate **130** actuates a muro-switch **386**, actuating brake cylinders **360** and **362** to lock table **27** into adjusted position. Switch **386** is also operative to interrupt the flow of air to double-acting cylinder **14**, thereby locking rod **16** thereof in its extended position.

Next the machine operator manually actuates cylinder **20** to extend rod **22** thereof, advancing compressed packages P through the first wrapping section F. When rod **22** reaches its limit of travel, cylinder **20** is deactuated. To accomplish this, there is provided an auxiliary rod **388** fixed at one end to cross-bracket **150** and slidably mounted in a receiving tube **390**. Tube **390** is as long as cylinder **20** while rod **388** is approximately as long as rod **22**. When rod **22** reaches its desired extended position, a cam block **392** on rod **388** trips a switch **394**, (see FIG. 8). Actuation of switch **394** interrupts the actuation of cylinder **20** to extend rod **22** and energizes cylinder **20** to retract rod **22**. Simultaneously, switch **394** energizes cylinder **14** to retract its rod **16** to permit free passage therepast of pusher plate **24**. Likewise, actuation of switch **394** de-energizes brake cylinders **360** and **362**, releasing table **27**.

As plate **24** returns to its original position as shown in FIG. 2, each extension **186** engages an associated bracket **188** on plates **162**, sliding plates **162** and their associated bearing plates **160** along key plates **168** back to their positions shown in FIG. 2.

When packages P are delivered to station T against end wall **67** by pusher plate **24**, they trip the operating arm **400** of switch **402**, arm **400** being disposed in their path of travel against wall **67** through an accommodating opening **404** therein. This completes a circuit through a suitable time delay mechanism (not shown) to actuate cylinder **72**, extending rod **74** thereof to transfer packages P from station T to section G. The time delay mechanism is employed to ensure that rod **22** and plate **24** have started their return before rod **74** is extended. However, to prevent springs **119** from urging packages P out of proper alignment in station G when the packages are released by plate **24** as it returns, switch **402** is operative to immediately actuate brake cylinder **359**, holding end wall **67** in position until packages P have been transferred to section G.

If desired, end wall **67** may extend into section G, past plows **104** and **112**, thus maintaining the proper completed package dimension as the partially-wrapped packages move from section F into and through section G.

At the end of the transfer operation, plate **76** is adapted to engage a micro-switch **406** which deactuates cylinder **72**, thereby retracting rod **74** and de-energizing cylinder **359** since braking is no longer needed as packages P are confined against side plows **104** and **112**.

Modification of FIGS. 14 and 15

In the embodiment of the invention shown in FIGS. 14 and 15 the top flaps **46** and **48** and bottom flaps **38** and **40** are folded into position by means of rotatable fold-

ing elements rather than plow elements. It has been found that such devices are preferable where the packages P are not of truly rectangular shape; such as compressed packages of flour, sugar and the like which have rounded edges.

In this embodiment, packages P are compressed as heretofore and advanced into the first wrapping section F of the modified form of machine designated generally 500. Flaps 34 and 36 are folded into position as heretofore by engagement with the front sections 502 and 504 plow members 506 and 508 respectively. Packages P are confined between plows 506 and 508 as adhesive applying devices 510 and 512 apply adhesive as heretofore in the first embodiment to the underside of flaps 46 and 48 respectively.

Continued advance of the packages P through section F' of machine 500, moves packages P between opposed side walls or guides 507 and 509 and brings bottom flaps 34 and 36 into contact with opposed lower rotatable folding elements 514 and 516 respectively which, as illustrated, are preferably smooth bowl-like metal disks. Folding elements 514 and 516 are adapted to fold their associated flaps 34 and 36 smooth and neatly against the sides of packages P. While folding elements 514 and 516 are completing the folding of flaps 34 and 36, top flaps 46 and 48 are engaged by opposed, upper rotatable folding elements 518 and 520 similar to elements 514, 516 and which are operative to fold their respective flaps 46 and 48 downwardly into overlying relationship with flaps 34 and 36 against the sides of packages P.

Folding elements 514 and 516 are mounted on separate support shafts 522 and 524 respectively suitably supported in bearings 526 and 528 and joined in common driving relationship by means of a universal joint 530. In like manner, folding elements 518 and 520 are mounted on separate shafts 532 and 534 suitably supported in bearings 536 and 540 and joined in common driving relationship by means of a universal joint 542.

Shaft 524 is provided with a sprocket 544 driven by chain 546 from a suitable power source; such as an electric motor (not shown) to rotate elements 514 and 516 together to fold their associated flaps 34 and 36. Likewise shaft 534 is provided with a sprocket 548 driven by chain 550 from a suitable power source (not shown) to fold flaps 46 and 48.

To adjust the position of the folding elements in response to the inward movement of plate 18, rack section 252 of bracket 250 again is in meshing engagement with pinion 254 on shaft 256.

In this embodiment, section F' includes a pair of support plates 552 and 554, with plate 554 movable toward and away from plate 52 to adjust the position of its associated members in response to the particular compression of the packages. To adjust plate 54, there is provided a pair of pinion gears 556 on shaft 256 in meshing engagement with associated rack sections 558 of a bracket 560 secured to the underface of plate 554. Brackets 560 also are mounted for lateral travel by means of rollers 562 in an associated channel 564 fixed to stationary underplate 566 mounted to the main machine frame.

In like manner the adhesive-applying device 510 is adjustably mounted to adjust the position of device 510 also in response to the compression of packages. This is accomplished by a pinion gear 568 mounted to and rotatable with shaft 256. Gear 568 is in turn, in meshing engagement with a rack section 570 on the main support bracket 572 of device 510. Bracket 572 is secured to a carriage 574 having rollers 586 adapting carriage 574 for lateral movement in associated channels 578 fixed to plate 566 to adjust the position of device 510.

In operation, when shaft 256 is rotated, as described heretofore, pinions 556 and 568 are also rotated, moving their associated rack sections 558 and 570 and brackets 560 and 570 laterally in their associated channels 564 and 576 respectively. Since brackets 570 are fixed to plate 554 this moves plate 554 relative to its associated plate 552. In like manner, since bracket 572 is fixed to carriage 574, this moves device 510 with plate 554 and plow 506 and side wall 507 to adjusted position in responsive to the compression of packages P.

It will be understood that means must also be provided for adjusting the position of folding elements 514 and 518 for proper folding of their associated flaps. To accomplish this, elements 514 and 518 are each slidably keyed on their associated shafts 522 and 532 as by elongated key means 580 formed in the disk-mounting hub 582 and shafts 522 and 532. This results in a driving connection between shafts 522, 532 and disks 514, 518 respectively. Shafts 522 and 532 are mounted in suitable bearings on the main frame. However, plate 554 includes a yoke bracket 584 depending downwardly from its underface and disposed in a suitable annular groove 586 in hub 582 of disk 514. Thus as plate 554 is moved as described heretofore, yoke bracket 584 in groove 586 slides hub 582 and disk 514 along shaft 522 to adjusted folding position. In like manner, plate 554 also includes a yoke bracket 588 on its upper surface with the yoke portion thereof positioned in an annnular groove 590 in hub 582 of disk 518 to move disk 518 with plate 554 to adjusted folding position.

In this embodiment, it was found desirable to move the folding elements such as plow 506, side wall 507 and folding disks 514 and 518 a distance equal to the distance traveled by plate 18. This was then accomplished by forming pinion gears 556 substantially identical to pinion gear 254 to optain a one-to-one ratio therebetween. As in the first described embodiment, adhesive applying device 510 need then be moved only one-half the distance of the folding elements which is accomplished by forming gear 568 of only one-half the diameter of gears 556 and 554.

Modification of FIG. 16

If it is desired, rather than have only one set of wrapping and securing elements move in response to the inward movement of plate 18 as in the foregoing embodiments of the invention, the wrapping and securing elements on both sides of the path of travel of packages P may be constructed and arranged to move toward their opposite number in response to movement of plate 18. The embodiment of the invention illustrated in FIG. 16 is adapted to operate on this latter principle. In the embodiment of FIG. 16 wherein like numerals represent like parts in the foregoing embodiments, plate 18 and its related plate elements, such as, bearing plate 160, mounting plate 162, and key plate 168 are mounted for movement into and out of engagement with packages to be compressed by master cylinder 14 as heretofore described in connection with the foregoing embodiments. In like manner as heretofore, plate 18 is opposed by plate 130 and its associated elements; such as bearing plate 160, mounting plate 162 and key plate 168.

As heretofore, plate 18 is provided with a downwardly depending bracket 600 which includes a rack section 602 slidably supported on support 603 a section 605 of the main machine frame. Rack 602 is in meshing engagement with a pinion 604 secured to and rotatable with a support shaft 606 which is mounted in suitable bearing in the main machine frame (not shown) and extends into the first wrapping section for reason hereinbelow set forth. Mounted on shaft 606 is a sprocket 608 about which is trained an endless chain 610. The other end of chain 610 passes around sprocket 612 carried by and rotatable with shaft 614 preferably located on the center-line CL of the machine as shown in FIG. 16. Shaft 614 includes a second sprocket 616 thereon about which is trained another endless chain 618. Chain 618 in turn passes around sprocket 620 mounted on and rotatable with another shaft 622 adjacent plate 130. Shaft 622 in turn is provided with a pinion 624 in meshing engagement with another pinion 626 carried by a support shaft 628 and rotatable there-

with. Shaft 628 like shaft 606 is mounted in suitable bearings in the main machine frame (not shown) and extends into the first wrapping section of the machine in spaced parallel relationships with shaft 606. Preferably shafts 622 and 606 are offset from the center-line CL in their respective directions an equal distance to provide, with shaft 614, a drive system substantially symmetrical about center-line CL.

Pinion 626, in turn, is in meshing engagement with a rack member 630 slidably supported on support 631 on section 605. Rack 630 is in turn secured to a bracket section 632 fixed to and downwardly depending from plate 130.

In operation, when during the cyclic operation of the machine, cylinder 14 is actuated moving plate 18 and its associated members into the compression station S to compress packages positioned threat, rack 602 causes pinion 604 meshing therewith, shaft 606 rotatable with pinion 604, and sprocket 608 rotatable with shaft 606, all to rotate counter-clockwise as shown in FIG. 16.

Such rotation of sprocket 608 advances chain 610 to advance in the direction of the arrows, FIG. 16. This in turn rotates sprockets 612, and 616. and their associated shaft 614 counter-clockwise, advancing chain 618 in the direction of the arrows, FIG. 16.

The advance of chain 618 in the direction of the arrows, FIG. 16 in like manner causes its associated sprocket 620, shaft 622 and pinion 624 to rotate counter-clockwise. However, pinion 624 is in meshing engagement with another pinion 626 such that counter-clockwise rotation of pinion 624 results in clockwise rotation of pinion 626 and its associated support shaft 628.

Since pinion 628 is also in meshing engagement with rack 630 on bracket 632, clockwise rotation thereof, advances rack 630 and thereby plate 130 and its associated elements into compression station S toward plate 18.

When cylinder 14 is actuated as heretofore described to withdraw plate 18 from operative compression position in station S, the foregoing movements of the pinion chains and shafts are reversed to return plate 130 in like manner to non-operative position.

It will be understood that the several pinions and sprockets are so constructed and arranged and their respective support shafts so positioned relative to the machine center-line CL that plates 18 and 130 advance an equal distance into station S.

Further, in this embodiment, only one air cylinder 14 need be employed to compress the packages. Just as plates 18 and 130 reach their pre-selected compression of packages at station S as determined by cylinder 14, a time delay valve (not shown) actuates the brake cylinders 360 and 362 and interrupts the flow of air to cylinder 14 as heretofore. The time delay valve is employed to permit final compression of packages to be achieved.

To move the wrapping elements on each side of the machine (not shown) a corresponding distance in response to the movement of plates 18 and 130 and thereby retain compressed package size while wrapping and to achieve a tight wrap, shafts 628 and 606 extend into the first wrapping section of the machine and actuate a drive system for such wrapping elements similar in construction and operation to the system for plates 18 and 130 in this embodiment so as to move the wrapping elements on each side of the machine an equal distance toward or away from each other in correspondence with the movement of their associated plates 18 and 130. Detailed description thereof is omitted in the interest of brevity.

Since the reference plane for this embodiment of the invention is the machine center-line CL rather than one stationary side of the machine as in the embodiments of FIGS. 1–15, the wrapping sheet trough and associated adhesive applicators in the present embodiment may be symmetrically fixed in position relative to center-line CL.

Thus, in the embodiment of FIG. 16, there is disclosed a machine wherein a tightly-wrapped, unitized cellular package is achieved by means of oppositely-movable compression elements and wrapping members with a fixed sheet trough and adhesive applications.

It will be understood that, if desired, compression plate 18 may, if desired, be adapted to compress packages P to a fixed width. However, spring-biased end wall 67 is adapted, by suitable selection of springs 119 and placement of stop cam 392 on rod 388, to cooperate with pusher plate 24 to apply a selected pressure to packages P at transfer station T compressing packages P thereat with a predetermined end pressure. In such instance, it is preferable for end wall 67 to extend into section G as described hereinbefore. Thus, the machine of the present invention is adapted to compress packages to at least one variable dimension to ensure a tightly-wrapped self-supporting finished package.

Thus, the machine of the present invention is operative to compress a plurality of individual packages into a self-supporting cellular, unitized structure and to wrap a single-ply sheet of flexible wrapping material tightly about such packages P to form a finished tightly-wrapped single-ply shipping container or package.

What is claimed is:

1. In a machine for wrapping a plurality of individual packages together in a sheet of flexible wrapping material, the combination comprising means for movement against said packages for compressing said packages with a selected compressing force into a self-supporting, cellular, unitized structure, means for draping a sheet of flexible wrapping material about said compressed packages, means for maintaining said packages in compressed condition during the draping of said sheet thereabout, means for wrapping said sheet tightly about said compressed packages, means for maintaining said packages in compressed condition during the wrapping thereof, means for adhering said sheet in tight-wrapping disposition about said compressed packages to form a completed single package of said compressed individual packages, means movably mounting at least selected wrapping means and means for moving said movably mounted wrapping means in response to the movement of said compression means against said packages whereby said wrapping means of said machine are properly disposed in said machine to tightly wrap said sheet about said compressed packages.

2. The machine as defined in claim 1 including means for advancing said compressed packages through said machine, means for supporting said sheet of material in the path of advance of said packages for draping thereabout, means movably mounting said sheet support means and selected adhering means and means for moving said sheet support means along with said selected wrapping and adhering means in response to the movement of said compression means to effect proper disposition of said sheet relative to the advance of said packages thereby ensuring a properly wrapped package.

3. The machine as defined in claim 1 wherein said compression means includes a pair of oppositely-movable compression elements and wherein at least one of said movable wrapping means is associated with each of said compression elements, and including common operating means for said compression elements and said wrapping means whereby each of said movable members is advanced a corresponding distance to said other movable members.

4. In a machine for wrapping a plurality of individual packages together in a sheet of flexible wrapping material, the combination comprising means for movement against said packages for compressing said packages with a selected compressed force into a self-supporting, cellular, unitized structure, means for advancing said com-

pressed packages through said machine and against a sheet of single-ply flexible wrapping material to drape said sheet thereabout, confining means for maintaining said packages in compressed condition during the advance of said packages, means for folding said sheet tightly about said compressed packages, means for maintaining said packages in compressed condition during the folding of said sheet, means for adhering said sheet in tightly-wrapped disposition about said compressed packages to form a completed single package of said compressed individual packages, means movably mounting selected folding means and means for operatively interconnecting said movable folding means and said compression means for moving said movably mounted folding means in response to the movement of said compression means against said packages whereby said folding means of said machine are properly disposed in said machine to tightly wrap said sheet about said compressed packages.

5. The machine as defined in claim 4 including means for supporting said sheet of material in the path of advance of said packages for draping thereabout, means movably mounting said sheet support means and selected adhering means and means for moving said sheet support means along with said selected folding and adhering means in response to the movement of said compression means to effect proper disposition of said sheet relative to the advance of said packages thereby ensuring a properly wrapped package.

6. The machine as defined in claim 4 wherein said folding means includes a plurality of plow elements disposed in the path of advance of said packages and sheet through said machine, said plow elements being operative to fold associated portions of said sheet against said compressed packages as said packages are moved therepast.

7. The machine as defined in claim 4 wherein said compression means includes a compression piston adapted to compress said packages sidewise at a compression station in said machine, and wherein said advancing means includes a pusher piston adapted to engage said compressed packages at said compression station and advance them past said sheet and a portion of said folding and securing means to a transfer station, a second pusher member adapted to engage said partially-wrapped compressed packages at said transfer station and advance them toward the remaining folding and securing means

and a conveyor system to advance said partially-wrapped packages past the remaining folding and securing means to complete the wrapping of said packages and deliver said wrapped package to a delivery station in said machine.

8. The machine as defined in claim 4 including common operative means for moving at least said selected folding means in timed synchronism as said packages are being compressed by said compression means.

9. The machine as defined in claim 5 including common operative means for moving said sheet support means and said selected folding and adhering means in timed synchronism as said packages are being compressed by said compression means.

10. A method of wrapping individual packages into a single package comprising the steps of providing a plurality of individual packages, compressing said packages into a self-supporting, cellular unitized structure by subjecting them to a selected compressive force, draping a sheet of flexible wrapping material about said compressed packages, advancing said compressed packages in compressed condition through a plurality of folding elements in a folding zone, adjusting the position of at least selected ones of said folding elements in response to the compression of said packages to tightly wrap said sheet about said packages as they are advanced therepast and adhering said sheet in tightly-wrapped disposition about said compressed packages.

11. The machine as defined in claim 4 wherein said folding means includes a plurality of rotatable folding disks disposed in the path of advance of said packages and sheet through said machine, said rotatable disks being operative to fold associated portions of said sheet against said compressed packages as said packages are moved therepast.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,383,825

May 21, 1968

Oliver R. Titchenal et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 37, "being" should read -- bring --. Column 5, lines 21 and 22, "flap 34" should read -- flaps 34 and 36 --. Column 8, line 63, "strips" should read -- strip --. Column 9, line 58, after "to" insert -- plate 18 --. Column 13, line 51, "52" should read -- 552 --; line 53, "54" should read -- 554 --. Column 14, line 31, "optain" should read -- obtain --. Column 15, line 17, "threat" should read -- thereat --; line 40, "pinion" should read -- pinions --. Column 16, line 6, "applications" should read -- applicators --; line 61, "compression" should read -- compressing --.

Signed and sealed this 9th day of December 1969.

(SEAL)

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