United States Patent

[11] 3,596,322

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[21] Appl. No. **22,186**
[22] Filed **Mar. 24, 1970**
Division of Ser. No. 738,972, June 21, 1968, Pat. No. 3,534,524
[45] Patented **Aug. 3, 1971**
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[54] **INDEX MECHANISM FOR A PACKAGING MACHINE**
3 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **18/20 C,** 74/822, 18/4 R
[51] **Int. Cl.** **B29c 3/04,** B23q 17/00
[50] **Field of Search** ..... 18/4 P, 4 R, 20 R, 20 C, 35, 19 F; 74/822; 214/1 BT, 8.5 D; 53/30, 18 A

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ABSTRACT: An index mechanism for a packaging machine having a transport mechanism for picking up individual package cards from a stack of cards and transporting the cards to a heating plate. The transport mechanism picks up another individual card from the heating plate and transports it to a forming die on an indexing mechanism. The indexing mechanism of this invention has four stations, the first of which causes synthetic plastic material on the package cards to be deformed into the shape of the cavities in the forming die. In the second station an item is placed in the package and the card folded. In the third station the card is sealed and in the fourth station the package card is removed from the indexing mechanism. The indexing mechanism has a plurality of hydraulic valves which are actuated sequentially to operate the indexing mechanism.

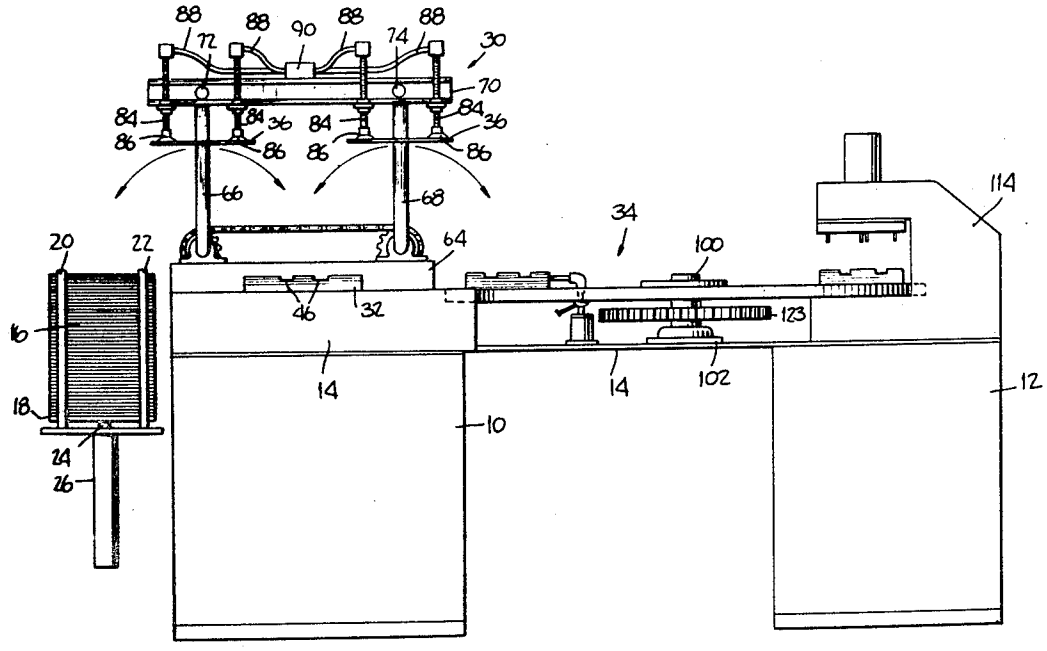


Fig. 1.

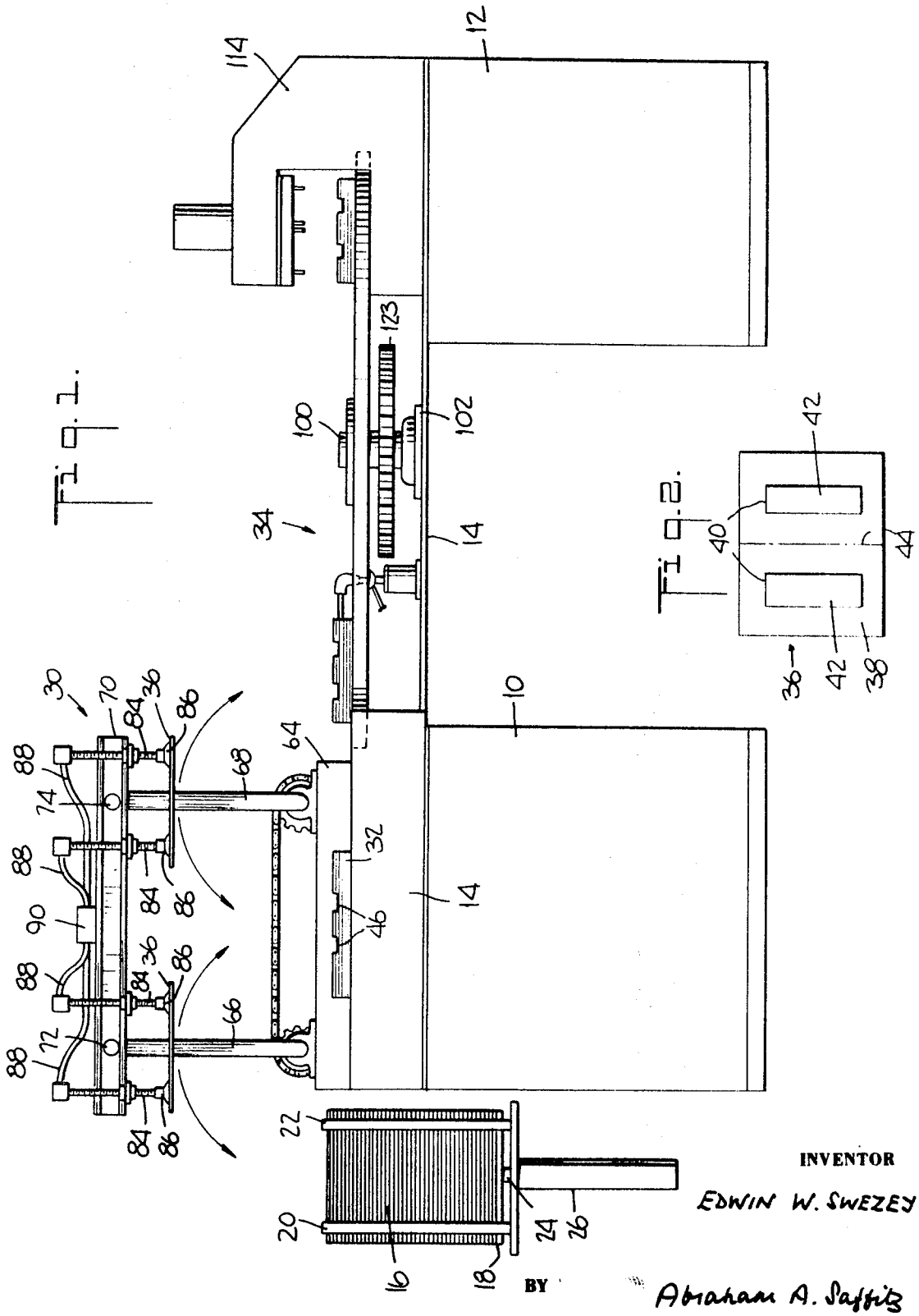


Fig. 2.

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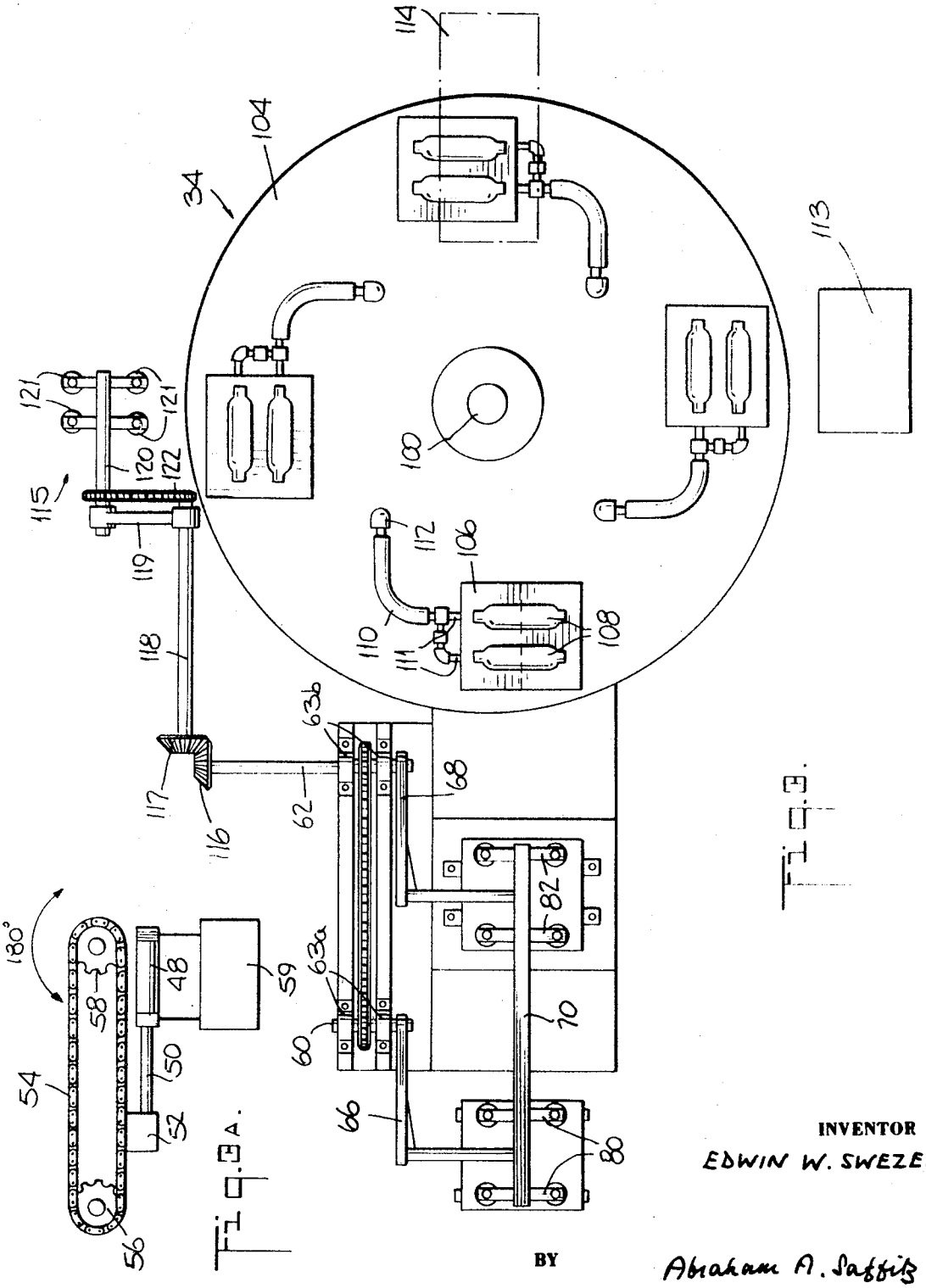


FIG. 3.

FIG. 3A.

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Fig. 4.

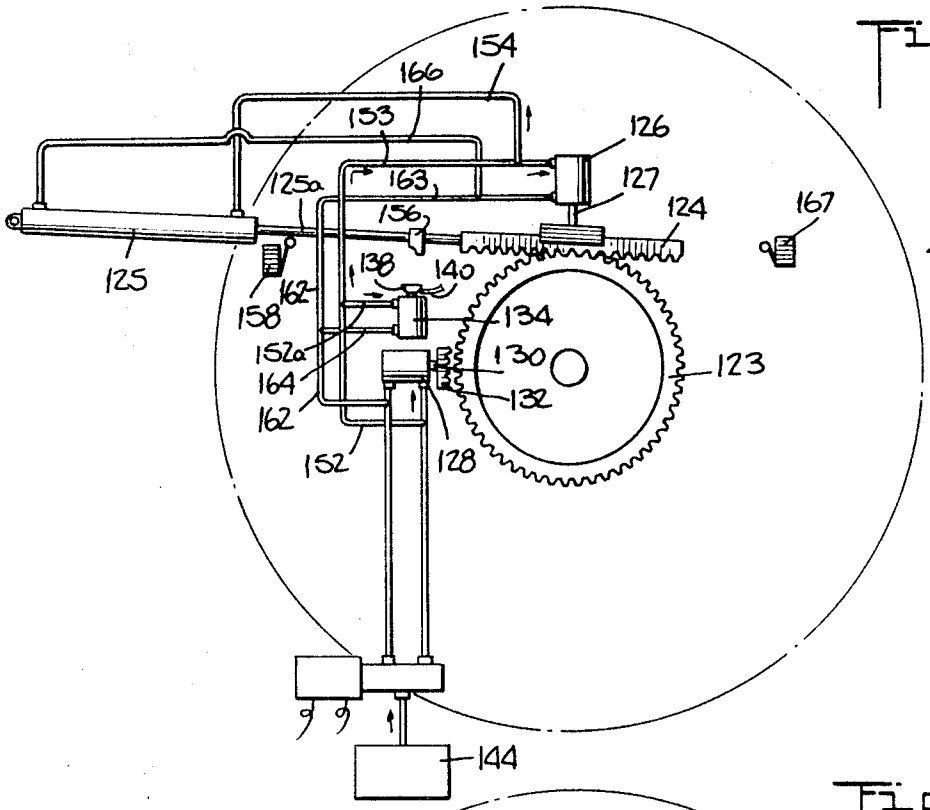
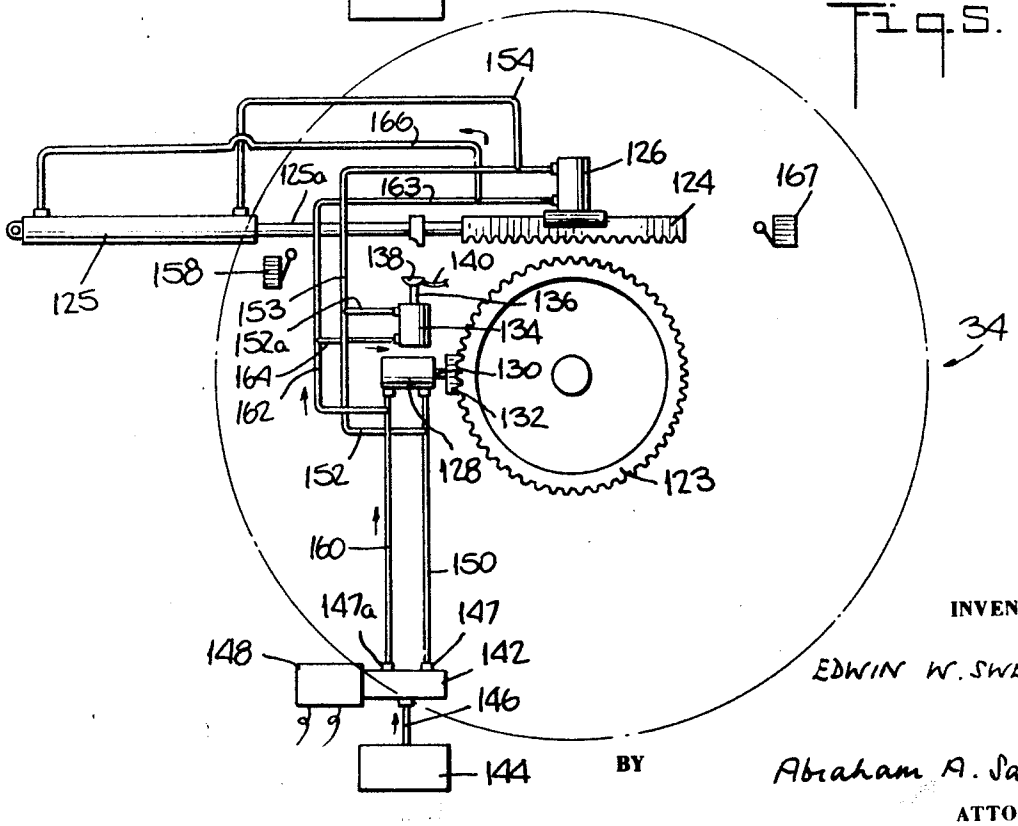


Fig. 5.



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INDEX MECHANISM FOR A PACKAGING MACHINE

RELATED U.S. APPLICATION

This application is a divisional application of my copending application Ser. No. 738,972, filed June 21, 1968, entitled "-Packaging Machine" now Pat. No. 3,534,524.

The present invention relates to packaging machines, and more particularly, to a novel packaging machine for packaging items in packages having window pockets of transparent synthetic plastic material for attractively displaying an item therein.

It is the object of the present invention to provide a novel packaging machine having a transport mechanism which picks up a package card from a supply thereof and transports the package card to a heating plate and simultaneously picks up another card from the heating plate and transports the card to a forming die on an indexing mechanism.

It is another object of this invention to provide such a packaging machine that has a hydraulically operated indexing mechanism with hydraulic cylinders that are operated sequentially.

It is another object of this invention to provide such a packaging machine that allows for a relatively short indexing and dwell time.

It is another object of this invention to provide such a packaging machine that is relatively inexpensive to manufacture and simple in operation.

Other objects of the invention will in part be readily apparent and will in part appear hereinafter.

THe invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

FIG. 1 is a side elevation view of the packaging machine of this invention.

FIG. 2 is a plan view of an individual package card for use with the packaging machine in FIG. 1.

FIG. 3 is a top view of the packaging machine of FIG. 1.

FIG. 3*a* is a partial side elevation view of the transport mechanism of the packaging machine of FIG. 1.

FIG. 4 is a partial partly diagrammatic plan view of the indexing mechanism of the packaging machine of FIG. 1 illustrating the position of the parts after the start of the indexing cycle.

FIG. 5 is a view similar to FIG. 4 illustrating the position of the parts of the indexing mechanism just before the indexing cycle has been completed.

It has been found that the foregoing and related objects can be readily attained in a packaging machine that has a support with a transport mechanism mounted thereon having a pair of operating arms rotatably mounted on the support and drive means connected to the arms for rotating the arms in one direction and then back in the opposite direction. Advantageously a carriage is mounted on the arms with the carriage for positioning the carriage in a plane generally parallel to the support during the rotation of the arms by the drive means. A pair of vacuum pickup members are mounted on the carriage, one of the vacuum pickup members is mounted adjacent one end of the carriage for engaging a first package card from a stack of cards positioned next to the packaging machine. This vacuum pickup member transports the first package card to a heater on the support when the drive means rotates the arms in one direction. The other of the vacuum pickup members is mounted adjacent the opposite end of the carriage simultaneously engaging a second package card positioned on the heater and transporting the second package card to a forming die on an indexing mechanism mounted on the support when the drive means rotates the arms in the aforementioned direction. Vacuum means are connected to the pair of vacuum pickup members to enable the vacuum pickup members to engage and transport the cards. The vacuum means has a control for releasing the vacuum in order that the cards may be deposited on the heater and the forming die.

THe packaging machine also includes an indexing mechanism with a shaft rotatably mounted on the support and a disc mounted on the shaft. A plurality of forming dies are supported by the disc for receiving the cards from the transport mechanism. The dies are adapted to deform heated synthetic plastic windows on the cards to the shape of the die for reception of the item to be packaged therein. Hydraulic means are provided for rotating the disc and shaft a predetermined increment. The hydraulic means includes a first hydraulic piston and cylinder wherein the first piston is connected to gear means for rotating the shaft. A second hydraulic piston and cylinder is provided wherein the second piston is connected to the gear means for moving the gear means into and out of engagement with the shaft. A third hydraulic cylinder and piston is provided wherein the third piston has a vacuum means connected thereto, the vacuum means being movable by the third piston for engagement with a vacuum tube connection to the forming die on the disc. A fourth hydraulic cylinder and piston is provided wherein the fourth piston is connected to a locking means for locking the shaft in a fixed position at the end of the indexing cycle. Hydraulic lines are provided for actuating the hydraulic cylinders and pistons and include a first set of hydraulic lines connected to one side of the hydraulic cylinders and a second set of hydraulic lines connected to the other side of the hydraulic cylinders. The first and second set of hydraulic lines are advantageously connected to the hydraulic cylinders in series to operate the pistons in the desired sequence. The hydraulic line may be connected in any series desired to the hydraulic cylinders in order to operate them in a particular sequence. The length and size of the hydraulic lines between the cylinders may be varied in order to change the timing of the sequential operation of the cylinders.

The hydraulic means desirably has a two-way valve that communicates on one side with the first set of hydraulic lines in one position and communicates with the second set of hydraulic lines in a second position. The two-way valve is actuated by a solenoid, the solenoid being actuated by a pair of switches operated by the first piston. The switches may be part of a timing mechanism that controls the dwell time, the operation of a sealing press and the operation of the transport mechanism.

The drive means for the transport mechanism has a pair of shafts rotatably mounted on the support, the shafts being attached to the pair of operating arms. A pair of sprockets are mounted on the shafts and are connected by a continuous chain. A hydraulic piston and cylinder is provided wherein the piston is connected to the chain to move the chain in one direction and then back in the opposite direction. One of the shafts has an extension connected to a takeoff arm rotatably mounted on the support. THe takeoff arm has a vacuum pickup means thereon for removing the processed package card from the indexing mechanism.

Referring now to the drawings, there is illustrated a packaging machine having a pair of supports **10** and **12** disposed on opposite sides on a horizontally extending base member **14**. As illustrated in FIG. 1 on the left-hand side of the packaging machine there is disposed a stack of cards **16** providing a supply of cards to be processed by the packaging machine.

The stack of cards **16** is supported by a plate **18** and is guided by pairs of guideposts **20** and **22** disposed on opposite sides of the plate **18** to hold the stack of cards **16** therebetween. The plate **18** is supported by a shaft **24** which is mounted in a hydraulic cylinder **26** adapted to move the shaft **24**, plate **18** and the stack of cards **16** upwardly as individual cards are removed from the stack. The level of the stack of cards **16** is controlled by an electrical and hydraulic device

(not shown) which maintains the upper level of the stack of cards 16 adjacent the upper portions of the guide posts 20 and 22. This device has a microlimit switch (not shown) which actuates a feed valve supplying fluid to the cylinder 26 in order to move the shaft 24 and lift the stack of cards 16 as individual cards are removed therefrom.

A card transport mechanism, generally designated by the numeral 30, is disposed on the base 14 above the support 10. The purpose of the card transport mechanism 30 is to take an individual card from the stack of cards 16 and position the card on a heating plate 32, suitably mounted on the base 14. After the card has been heated by the heating plate 32 the card transport mechanism 30 then moves the heated card to an indexing mechanism, generally designated by the numeral 34 to be described in detail hereinafter.

Each individual card 36, as illustrated in FIG. 2, is made of rectangular sheet material 38 having a pair of rectangular apertures 40 formed therein. Each card 36 is made in a conventional manner with transparent synthetic plastic sheet material 42 supported by the sheet material 38 to cover the apertures 40 in the same plane as the sheet material thereby forming a pair of windows in each individual card 36. The synthetic plastic material 42 is deformable when heated to form a pocket so that the individual card 36 may be folded about a fold line 44 formed on each card 36 to enclose an item to be packaged in the pocket with the packaged item readily visible on either side of the package through the transparent plastic sheet material 42.

The heating plate 32 has suitably positioned heating elements 46 spaced to conform to the position of the rectangular apertures 40 in each individual card 36 so that the synthetic plastic material 42 may be heated when placed upon the heating plate 32.

The card transport mechanism 30 is driven by means of a hydraulic cylinder 48 which has a piston and shaft 50 mounted therein which is fixedly connected by a fastener 52 to a drive chain 54 mounted between a pair of sprockets 56 and 58. One end of the hydraulic cylinder 48 is supplied with hydraulic fluid from a conventional pump mechanism 59 causing the shaft 50 to first move to the left, as viewed in FIG. 3*a*, thereby moving the chain 54 and rotating the sprockets 56 and 58 in a clockwise direction. The sprockets 56 and 58 are rotated in a counterclockwise direction, as viewed in FIG. 3*a*, when hydraulic fluid is supplied to the other end of the hydraulic cylinder 48 so that the shaft 50 is moved to the right.

The sprockets 56 and 58 are mounted on shafts 60 and 62 respectively which are supported by pairs of bearing members 63*a* and 63*b* mounted on a support 64 attached to the base 14. Outwardly extending portions of the shafts 60 and 62 are fixedly connected to end portions of a pair of operating arms 66 and 68. The opposite ends of the operating arms 66 and 68 support a carriage 70 by means of shafts 72 and 74 respectively, which are pivotally connected to the carriage 70. This construction allows for movement of the carriage 70 through an arc while remaining generally parallel to the plane of the base 14.

In order to transport individual cards 36 from the stack of cards 16 to the heating plate 32 and then to the index mechanism 34, the carriage 70 is provided with a pair of vacuum pick devices mounted adjacent opposite ends thereof. For this purpose two pairs of perpendicularly mounted bars 80 and 82 are attached adjacent each end of the carriage 70. The outwardly extending extremities of each of the bars 80 and 82 support hollow vacuum fingers 84 each of which have, at lower end thereof, vacuum cups 86 attached thereto. Each of the vacuum cups 86 has a suitable aperture communicating with the fingers 84. The opposite ends of the vacuum fingers 84 are connected to vacuum lines 88 which extend to a central conduit 90 which is connected with a conventional vacuum pump forming a vacuum in the lines so that individual cards 36 may be engaged by the vacuum cups 86.

As illustrated in the drawings there are four suitably spaced vacuum fingers 84 and vacuum cups 86 on both ends of the carriage 70 so that all four corners of each individual card 36 will be engaged by the vacuum cups 86 in order to effectively transport the individual cards 36 for processing by the packaging machine.

THe operation of the card transport mechanism 30 provides for picking up an individual card 36 from the stack of cards 16 by the four vacuum cups 86 on one end of the carriage 70 and simultaneously picking up another individual card 36 disposed on the opposite end of the carriage 70. This movement occurs when conventional control means causes the pump mechanism 59 to supply hydraulic fluid to one end of the hydraulic cylinder 48 to move the shaft 50 to the right as viewed in FIG. 3*a* thereby causing the sprockets 56 and 58 and the shafts 60 and 62 to rotate in a counterclockwise direction so that the operating arms 66 and 68 also rotate in a clockwise direction causing the four vacuum cups on the left-hand side of the carriage 70, as viewed in FIG. 1, to be positioned on top of the stack of cards 16 whereby an individual card 36 is engaged. Simultaneously the four vacuum cups 86 mounted on the right-hand side of the carriage 70 engage another individual card 36 disposed on the heating plate 32.

THe next part of the cycle is initiated when conventional control means causes the pump mechanism 59 to supply hydraulic fluid to the other end of the cylinder 48 thereby causing the piston 50 to move to the left and the sprockets 56 and 58 and the shafts 60 and 62 to be rotated in a clockwise direction as viewed in FIG. 3*a*. The consequence of this rotation is that the operating arms 66 and 68 are rotated in a clockwise direction as viewed in FIG. 1 causing a pair of cards picked up by the carriage 70 to be removed respectively from the stack of cards 16 to the heating plate 32 and from the heating plate 32 to the indexing mechanism 34.

The indexing mechanism 34 has a vertical shaft 100 rotatably supported in a bearing housing 102 mounted on the base 14. Adjacent the upper end of the vertical shaft 100 there is mounted in a horizontal plane a relatively large disc 104 which is fixed to the shaft 100 for rotation therewith. Four forming dies 106 are mounted near the outer periphery of the disc 104 on the upper surface thereof and are spaced at 90° intervals. Each forming die 106 has a pair of generally rectangular-shaped cavities 108 adapted to conform to the shape of the apertures 40 of the individual card 36.

When the transport mechanism 30 places a card 36 on a forming die 106 positioned by the indexing mechanism 34 adjacent the card mechanism 30, the heated synthetic plastic material 42 is drawn into the cavities 108 and deformed to conform to the shape thereof by means of a vacuum created through a line 110 having a pair of leads 111 on one end extending into each of the cavities 108 and a connection 112 on the other end thereof leading downwardly through the disc 104.

After an individual card 36 has been placed on a die 106 and the plastic material 42 deformed to the shape of the cavities 108, the disc 104 is rotated 90° by means described hereinafter, in a counterclockwise direction, as viewed in FIG. 3, so that the card 36 is moved adjacent to a loading station 113. At this point in the cycle an individual or automatic means loads an item to be packed into the outer cavity 108 adjacent the periphery of the disc 104 and folds the card 36 along the fold line 44 so that the item is enclosed by the card 36 within the pocket formed by the deformed synthetic material 42.

The disc 104 is again indexed 90° in a counterclockwise direction so that the folded card 36 is presented at a station underneath a dielectric sealing press 114. At this point in the cycle, the sealing press seals the contiguous surfaces of the sheet material 38 in a conventional manner closing the card 36 into an airtight package. The disc 104 is then again indexed through 90° positioning the sealed card 36 opposite a takeoff mechanism, generally designated by the numeral 115, which removes the sealed card 36 from the forming die.

THe takeoff mechanism 115 is driven by shaft 62 and is operated simultaneously with the card transport mechanism

30. The shaft 62 has an extension with a bevel gear 116 mounted thereon meshing with a complementary bevel gear 117 attached to one end of a shaft 118. The shaft 118 is suitably mounted for rotation on the base 14 and has an arm 119 secured to its opposite end for rotation therewith. The arm 119 has a carriage shaft 120 extending perpendicularly therefrom with four vacuum pickup members 121 mounted thereon. The vacuum pickup members 121 are constructed in the same manner as the vacuum fingers 84 and vacuum cups 86 previously described and are similarly connected to a vacuum-forming means. The vacuum pickup members 121 are appropriately spaced to pick up a processed card 36 from a die 106 positioned adjacent thereto by the indexing mechanism 34 and to release the card 36 at a position spaced from the packaging machine. A chain 122 is mounted on sprockets on the shafts 118 and 120 in order to keep the pickup members 121 in the same plane as the die 106.

The above-described cycle is a continuing one wherein as one card 36 is having its plastic material 42 drawn into the cavities of a die 106 positioned adjacent the card transport mechanism 30, another card is being loaded with an item to be packaged at the next adjacent station. Simultaneously, another card 36 is being sealed at the station under the press 114 while another card 36 is being removed from a die 106 by the takeoff mechanism 115. The disc 104 is rotated at 90° increments by means of gear 123 mounted on the shaft 100 below the disc 104. FOr this purpose an indexing rack 124 is engageable with the gear 123 and is driven by a hydraulic cylinder 125 which is connected to the rack 124 by means of a piston and shaft 125*a*. The hydraulic cylinder 125 and the rack 124 are adapted to rotate the gear 123 through 90° when the shaft 125*a* is pulled to the left by the hydraulic cylinder 125 as viewed in FIG. 4. A second hydraulic cylinder 126 has a piston and shaft 127 connected to the rack 124 for disengaging the rack 124 from the gear 123 after the gear 123 has been indexed 90°. Subsequently, the hydraulic cylinder 125 is again supplied with hydraulic fluid to move the rack 124 to the right, as viewed in FIG. 5, so that it is repositioned to rotate the gear 123 during the following cycle. When the next cycle is started the second hydraulic cylinder 126 causes the shaft 127 to move the rack 124 into reengagement with the gear 123.

A third hydraulic cylinder 134 is provided with a piston end shaft 136 having a vacuum cup 138 on the free end thereof which is moveable into engagement with the vacuum conduits 110 connected to the forming dies 106 when the dies 106 are indexed to the station adjacent the card transport mechanism 30. A vacuum line 140 is connected to the vacuum cup 138 and to a conventional vacuum pump in order to produce a vacuum in the cavities 108 of the forming die 106 which is positioned adjacent the card transport mechanism 30.

A fourth hydraulic cylinder 128 is provided which is adapted to move a piston and shaft 130 with a toothed locking pawl 132 on the free end thereof into and out of engagement with the gear 123. Before the gear 123 is indexed, the hydraulic cylinder 128 moves the toothed locking pawl 132 out of engagement with the gear 123. When the indexing cycle has been completed, the hydraulic cylinder 128 moves the shaft 130 causing the toothed pawl 132 to reengage the gear 123 to lock the indexing mechanism 34 in a fixed position.

Advantageously, this invention provides for actuating the four hydraulic cylinders 125, 126, 134 and 128 in sequence by the use of only one hydraulic valve 142 in the following manner. A continuous hydraulic fluid pump 144 supplies hydraulic fluid through a line 146 to the valve 142 which is actuated by a solenoid 148. The valve 142 is a two-way valve having one inlet connected to the line 146 and two outlets 147 and 147*a*. The valve 142 is operated by the solenoid 148 to either allow fluid to flow through outlet 147 or through outlet 147*a*. The valve 142 may also be positioned by the solenoid 148 to prevent fluid from flowing into either of the outlets 147 and 147*a*.

At the start of the indexing cycle, the valve 142 allows fluid to pass through outlet 147 and into line 150 which supplies fluid first to one side of the hydraulic cylinder 128 whereby the toothed pawl 132 is disengaged from the gear 123 and the indexing mechanism 34 unlocked.

Sequentially, hydraulic fluid then flows from the line 150 into lines 152 and 152*a* and to one side of the hydraulic cylinder 134 causing the piston 136 to retrace the vacuum cup 138 from engagement with the conduit 110. Fluid from the line 152 then continues to flow to a line 153 where the fluid then enters one side of hydraulic cylinder 126 causing the shaft 127 to move the rack 124 into engagement with the gear 123. Hydraulic fluid from the line 152 continues to flow into a line 154 and to one side of the hydraulic cylinder 125 causing the shaft 125*a* to pull the rack 124 to the left thereby indexing the disc 104 through 90°, a stop 156 on the shaft 125*a* actuates an electrical switch 158 which causes the solenoid 148 to actuate the two-way valve 142 to close the outlet 147 of the valve 142 thereby terminating this portion of the indexing cycle.

Immediately after the above-described portion of the indexing cycle, the solenoid 148 then actuates the valve 142 to allow fluid to be supplied by the hydraulic pump 144 through the outlet 147*a* into a hydraulic line 160 whereby fluid enters the other side of the hydraulic cylinder 128 causing the shaft 130 to move the toothed pawl 132 into engagement with the gear 123 thereby locking the indexing mechanism 34. Sequentially, fluid then flows from the hydraulic line 160 into a hydraulic line 162 and into a line 164 where the fluid enters the other side of hydraulic cylinder 134 causing the shaft 136 to move the vacuum cup 138 into engagement with the conduit 110 for creating a vacuum in the cavities 108 of the forming die 106 positioned at the station adjacent the card transport mechanism 30.

Fluid continues to flow sequentially from line 162 into line 163 where it enters the other side of hydraulic cylinder 126 and moves the shaft 127 and the rack 124 from engagement with the gear 123. Fluid then continues to flow from the hydraulic line 163 into a hydraulic line 166 where it enters the other side of the hydraulic cylinder 125 causing the shaft 125*a* and the rack 124 to move to the right, as viewed in FIG. 5, returning the rack 124 into its starting position for the next indexing cycle. As the rack 124 reaches its starting position, it contacts the switch 167 which starts a timer which after a time interval actuates the solenoid valve 148 to close the valve 142, thereby beginning the next cycle.

Advantageously the operation of the hydraulic cylinders 125, 126, 134 and 128 are operated in sequence by the hydraulic fluid flowing through the hydraulic lines without the necessity of a plurality of hydraulic valves. By providing a single hydraulic valve 142 fluid is allowed to flow into the hydraulic cylinders in sequence to operate the indexing mechanism 34 in the desired manner with a minimum of controlled valves and operating parts.

The solenoid 148 and the switches 158 and 167 are conventional electrical and mechanical devices adapted to operate the indexing mechanism 34. Similarly, the vacuum means for forming a vacuum at cups 86, 121 and 138 is conventional equipment well known in the art as are controls for releasing the vacuum at such cups.

It will be understood that the foregoing description with the details of exemplary structure is not to be construed in any way to limit the invention, but that modifications may be made thereto without departing from the scope of the invention as set forth in the following claims.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure to Letters Patent is:

1. A packaging machine indexing mechanism comprising a support; a shaft rotatably mounted on said support; a disc mounted on said shaft; a plurality of forming dies mounted on said disc, said forming die having a vacuum tube connection; indexing means for rotating said shaft and disc through predetermined increments, said indexing means including a first hydraulic piston and cylinder, said first piston being connected to a rack gear engageable with a pinion gear mounted on said shaft for rotating said shaft, a second hydraulic cylinder and piston, said second piston being connected to said rack gear for moving said rack gear into and out of engagement with said pinion gear, a third hydraulic cylinder and piston, said third piston having vacuum means connected thereto, said vacuum means being movable by said third piston for engagement with said vacuum tube connection of said forming die, a fourth hydraulic cylinder and piston, said fourth piston being connected to a pawl engageable with said pinion gear on said shaft, said pawl being movable into engagement with said pinion gear to lock said shaft and disc in a fixed position; hydraulic means for actuating said indexing means including a first set of hydraulic lines connected to one side of said hydraulic cylinders and extending first to said fourth cylinder, then to said third cylinder, then to said second cylinder, then to said first cylinder, said pistons in said cylinders being operated in sequence to disengage said pawl from said pinion gear, to disengage said vacuum means from said forming die connection, to engage said rack gear with said pinion gear and to translate said rack gear to cause rotation of said pinion gear and shaft for a predetermined indexing increment; said hydraulic means having a second set of hydraulic lines connected to the other side of said hydraulic cylinders and extending first to said fourth cylinder, then to said third cylinder, then to said second cylinder, then to said first cylinder, said pistons in said cylinders being operated in sequence to engage said pawl with said gear, and to engage said vacuum means with said forming die connection, to disengage said rack from said gear and to return said rack to its starting position for the next indexing cycle.

2. The packaging machine indexing mechanism of claim 1 wherein said hydraulic means has a two-way valve, said valve communicating with said first set of hydraulic lines in one position and communicating with said second set of hydraulic lines in a second position.

3. The packaging machine indexing mechanism of claim 2 wherein said two-way valve is actuated by a solenoid and wherein said solenoid is actuated by a pair of switches operated by said rack.