March 3, 1970 J. R. HARDER ET AL 3,498,021

PACKAGING MACHINE

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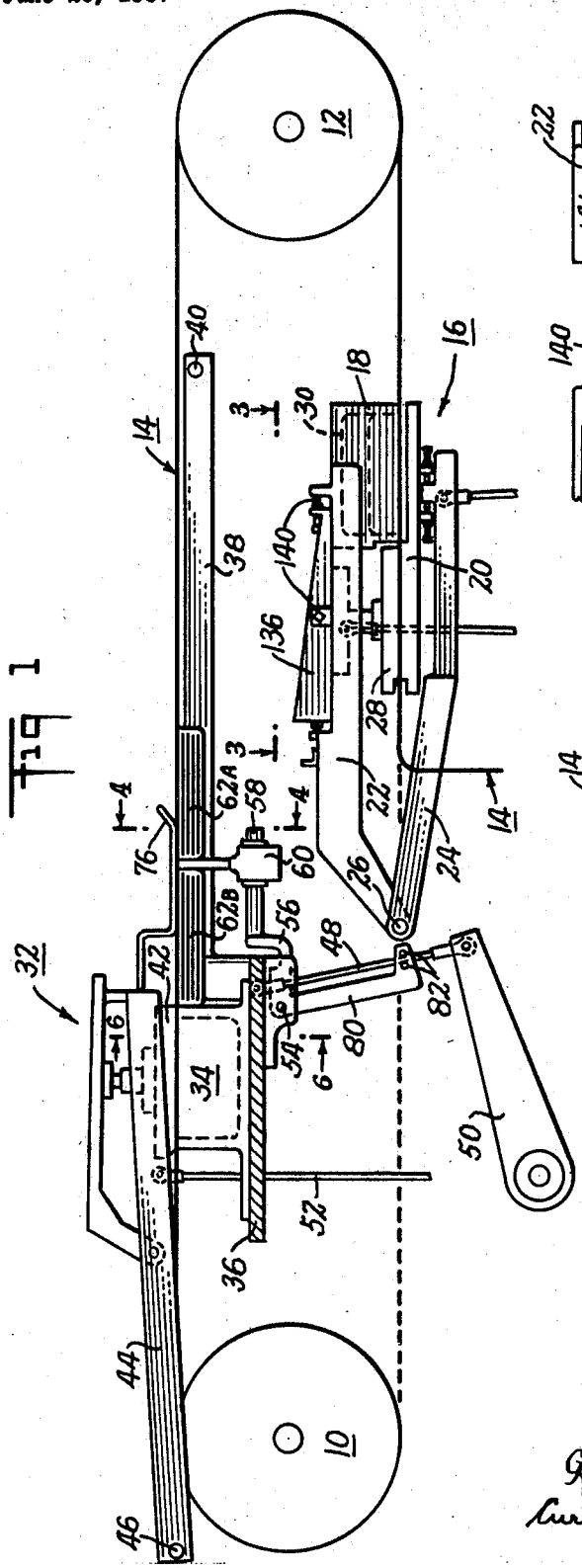

Fig. 1

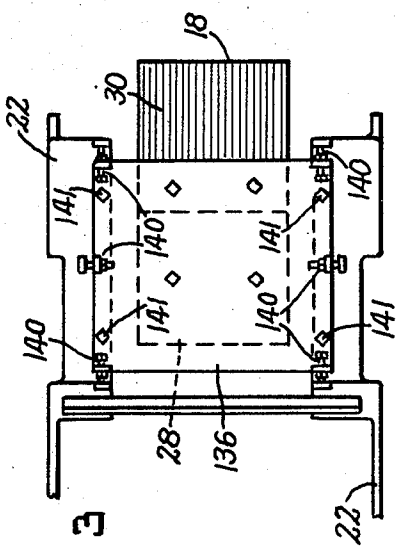

Fig. 3

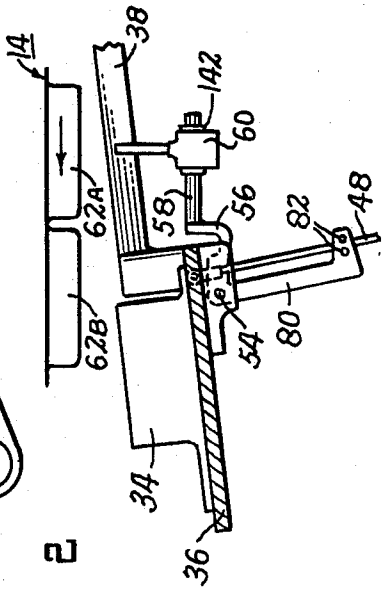

Fig. 2

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Fig 4

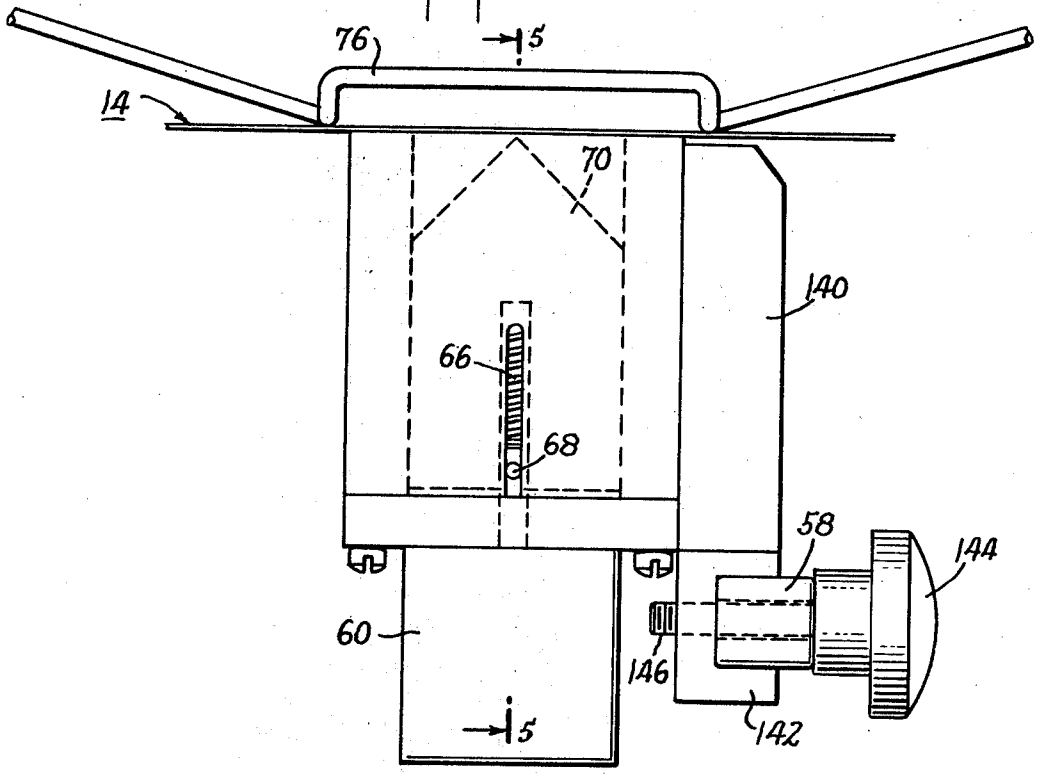
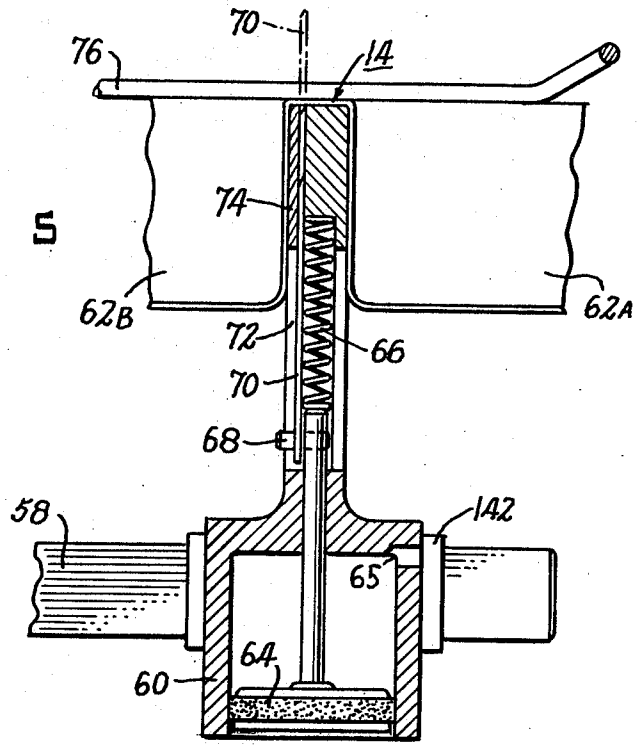


Fig 5



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PACKAGING MACHINE

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Fig 6

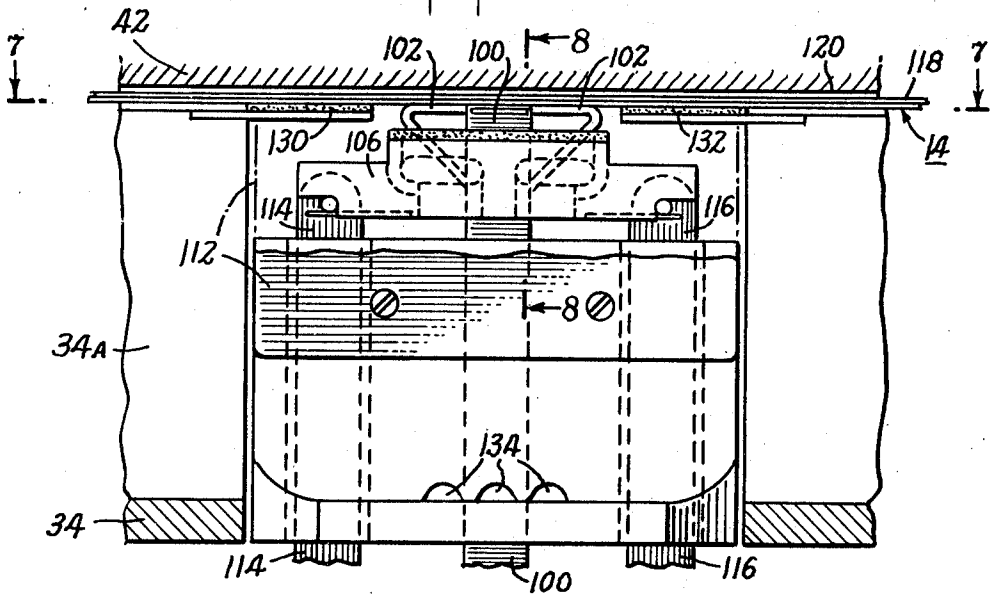


Fig 7

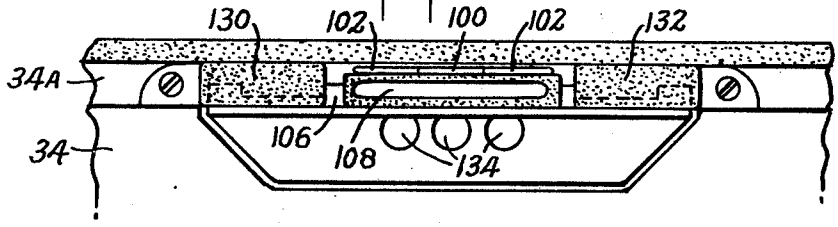


Fig 8

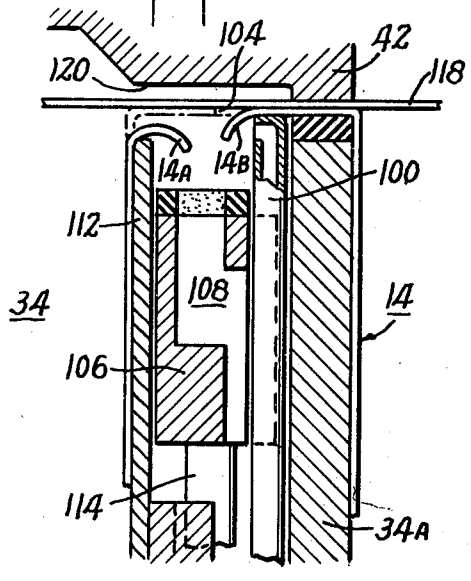
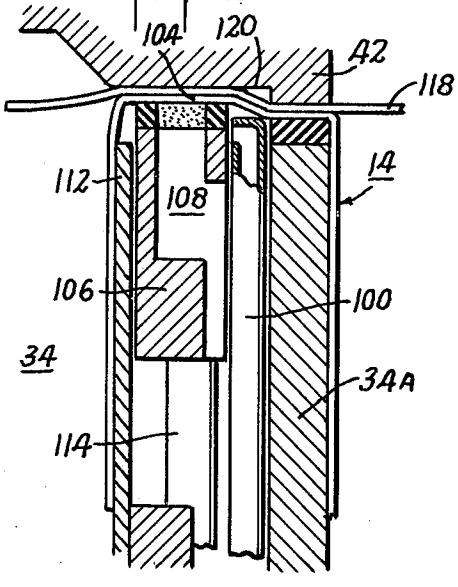


Fig 9



United States Patent Office 3,498,021
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3,498,021

PACKAGING MACHINE

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Int. Cl. B65b 9/04, 31/04
U.S. Cl. 53—112 15 Claims

ABSTRACT OF THE DISCLOSURE

Automatic packaging machine wherein a continuous web of flexible plastic film is indexed in intermittent steps by chain-driven clips around a path past a forming station where the film is drawn into product receiving cups and thereafter to a finishing station including a sealing die in which the cup is sealed to a plastic top and evacuated, there being provided a power-operated slitter knife arranged for high-speed penetration of the film to make an evacuation opening, there further being provided in the sealing die a reciprocable pressure bar with an interior passage normally aligned with the previously made evacuation opening, the film adjacent the opening being held away from the pressure bar during evacuation by support surfaces located on opposite sides of the bar.

This invention relates to automatic packaging apparatus of the type adapted to form evacuated packages from continuous webs of packaging material. More particularly, this invention relates to improved means for making and evacuating such packages.

Various types of packaging machines have been used for a number of years for converting continuous webs of flexible packaging material into hermetically sealed and evacuated packages. One of the early successful machines in shown in U.S. Patent 3,061,984, and comprises a number of packaging trays secured to an endless chain for movement around a generally oval-shaped path. Packaging operations are performed at stations adjacent this path and include the steps of applying a continuous web of plastic film to the trays, stretching the film into the trays to form receptacles in the shape of cups, loading products into the cups, sealing a cover film across the open mouth of the filled cups, and evacuating each completed package.

More recently, a new packaging machine has become available, as disclosed in U.S. patent application Ser. No. 526,081, filed on Feb. 9, 1966 by Joel A. Hamilton. This machine does not utilize movable packaging trays to carry the plastic film past various operating stations, but instead advances the film by means of chain-driven clips which grip the edges of the continuous web of film. At one packaging station, a forming die stretches the plastic film interiorly of the clips to produce cups which are unsupported by trays or the like while the film is advanced to perform subsequent packaging operations. After these cups have been filled with products, they are advanced to a finishing station having a reciprocable sealing die which both seals and evacuates the package at a single position. One important advantage of this type of machine is that it can readily be altered to handle different package sizes, since basically it is necessary only to replace the forming and sealing dies, whereas in the earlier machine design described above a change of package size in most instances would have required a complete change of all trays of the machine.

In this new machine described in application Ser. No. 526,081, the packages are evacuated through a slit in the flange portion of the packaging film adjacent the mouth of each cup. In order to obtain rapid evacuation of the package when it is in the sealing die, this evacuation slit should always be at least substantially aligned with the external evacuation passage through which the air is being evacuated, and this relationship should be maintained consistently regardless of normal variables and tolerances in the packaging machinery. Also, during evacuation the film around the slit should be suitably controlled in order to present a large size opening for the outrush of air from the package. The apparatus disclosed herein solves these and related problems.

Accordingly, it is an object of this invention to provide automatic packaging apparatus which is superior to those available heretofore. A specific object of this invention is to provide such apparatus which is capable of evacuating packages rapidly and reliably. Other objects, aspects, and advantages of this invention will in part be pointed out in, and in part apparent from, the following description considered together with the accompanying drawings, in which:

FIGURE 1 is a longitudinal section, with certain portions omitted for clarity, showing the major operating sections of an automatic packaging machine embodying the present invention;

FIGURE 2 is a detailed view showing the sealing die and the slitter knife in disengaged position while the package cups are in transit between dwell periods of the indexing cycle;

FIGURE 3 is a horizontal section taken along line 3—3 of FIGURE 1 to show the plan outline of the removable forming die and its support structure;

FIGURE 4 is a vertical cross section taken along line 4—4 of FIGURE 1 to show the construction of the slitter knife and the web backup frame;

FIGURE 5 is a vertical section taken along line 5—5 of FIGURE 4;

FIGURE 6 is a detail cross section taken along line 6—6 of FIGURE 1, particularly to show the construction of the evacuation elements;

FIGURE 7 is a horizontal section taken along line 7—7 of FIGURE 6;

FIGURE 8 is a cross section taken along line 8—8 of FIGURE 6; and

FIGURE 9 is a cross section similar to FIGURE 8, but with the pressure bar shown in its engaged position.

Referring now to FIGURE 1, the machine comprises two sets of sprockets **10** and **12** adapted to receive a pair of endless side-by-side chains for movement around a path which is generally oval in configuration. As disclosed in the above-mentioned copending application Ser. No. 526,081, these chains carry spring-loaded clips (not shown herein) which grip the side edges of a continuous web of flexible packaging film, generally indicated in solid outline at **14**, and carry that film around the path of movement of the chains to accommodate packaging operations at certain positions.

Conventional drive means (not shown) rotates the sprockets **10** with an intermittent motion so as to provide indexing steps with intervening dwell periods for performing the packaging operations. The film **14** is applied to the chain-carried clips on the lower reaches of the chain path, and is advanced first through a forming station generally indicated at **16**. This station comprises upper and lower formers **18** and **20** carried by respective pairs of arms **22** and **24** which are pivotally mounted at **26** to accommodate reciprocal motion of the formers towards and away from the packaging film.

The upper former **18** includes a heating plate **28** and a relatively deep forming die **30**. As described in more detail in the above-indentified copending application, the film first is heated by the plate **28** to soften it for subsequent stretching. Thereafter, the heated film is indexed

to the forming die 30 where it is drawn into the shape of a cup by vacuum means.

The cups made by the forming die 30 are indexed around the right-hand sprocket 12 to the upper reaches of the chain path where the cups are loaded with the products to be packaged. The filled cups then are indexed to a final sealing station generally indicated at 32. As the cups enter the final sealing station, a second film of flexible packaging material is fed from a supply roll (not shown) to a position over the cup mouth to serve as a top for the package.

The final sealing station 32 comprises a sealing die 34 which is removably mounted on a base 36 carried by a pair of arms 38 the right-hand ends of which are pivotally mounted at 40 to provide generally up-and-down reciprocating movement of the sealing die. Above this die is a sealing clamp 42 carried by a pair of arms 44 which are pivotally mounted on their left-hand end 46 for reciprocating motion. The base 36 is reciprocated by a push rod 48 pivotally secured at its lower end to a cam-driven arm 50. The upper arms 44 are similarly reciprocated by a rod 52 which is driven synchronously with rod 48.

During each dwell period of the indexing cycle, the sealing die 34 is moved up to embrace the filled cup then above the die, and the sealing clamp 42 is simultaneously moved down to seal this cup to its top film, as described in the above-identified copending application. Thereafter, the sealed package is evacuated through a slit in the cup flange. This evacuation slit is produced by means now to be described.

Pivotally attached to opposite sides of the base 36 at 54 is a support 56 comprising a bar 58 extending to the right to carry a pneumatic actuator 60. This actuator moves up and down with the base 36, and in its upper position is located between two adjacent cups 62A and 62B, directly beneath the flange portions thereof. As illustrated in FIGURES 4 and 5, this actuator includes a piston 64 adapted to be driven upwards, against a return spring 66, by applying vacuum to a passage 65 by a flexible hose or the like (not shown). A pin 68 fastens the piston to a slitter knife 70 and slides in a slot 72 of a guide plate 74 which assures that the knife moves directly upwards.

The leading edge of the knife is sharp and pointed, and pierces the film 14 between the two adjacent cups 62A and 62B to make an opening in the form of a transverse slit suitable for subsequent evacuation of the final completed package as will be described. To assure that the knife 70 properly and consistently pierces the film, the piston 64 is driven with considerable speed (i.e. much more rapidly than the reciprocating movement of the actuator as it moves with the base 36), and at the instant of penetration the film is engaged from above by a wire-like frame 76 mounted on the arms 44. This frame forms the outline of a horizontal planar surface, and holds the film in place with respect to vertical movement during the slit-forming operation.

Since the pneumatic actuator 60 is carried by the base 36, the actuator drops down from its operating position when the base is shifted down before the next indexing step. If the actuator were rigidly attached to the base, this downward movement of the actuator would be less than that of the base, because the actuator is closer to the pivot point 40 of arms 38. Under such circumstances, the cup 62A would be apt to strike the top of the actuator and possibly damage the package. To avoid this possibility, special means are provided to augment the vertical motion of the actuator to such an extent that it moves down very nearly the same amount as the base.

For this purpose, the actuator support 56 includes (see FIGURE 1) an elongate arm 80 which extends down alongside of the corresponding push rod 48 and is provided at its lower end with horizontal guide pins 82 on opposite sides of the push rod. As the push rods 48 are moved up and down by the cam arm 50, the support 56 is maintained by arm 80 in a substantially fixed angular relationship with respect to the push rods. The design of the base reciprocating mechanism is such that as the push rods 48 move up and down, their angular orientation does not change significantly. Thus, as shown in FIGURE 2, the support bar 58 remains horizontal as it moves to its down position, so that the actuator 60 actually travels a distance essentially equal to the corresponding motion of the base 36. This arrangement avoids any interference with the cup 62A during its subsequent indexing movement.

It will be apparent that in the arrangement just described the evacuation slit is made immediately before the cup is advanced into the final sealing station 32. One special advantage of this arrangement is that the positioning of the slit with respect to the evacuation passage in the sealing die 34 can thereby be controlled relatively closely, as compared for example to a machine arrangement where the slit is made at some earlier stage of the packaging operation, e.g. when the cup is formed. This increased precision in slit positioning assures closer alignment between the slit and the evacuation passage, thereby aiding in effecting more reliably rapid evacuation of the sealed package.

Of course, in order to make the slit just before final sealing, it must be formed at a place where the film lacks support by dies or trays such as used in earlier machines, and this factor creates special problems in making a proper evacuation slit consistently. The pressure and weight of the product in the unsupported cup at this time adds to these problems. These problems have been satisfactorily solved, however, by the use of a high-speed slitter knife, and by holding the film against upward movement during the short time the knife penetrates the film.

Referring now to FIGURES 6–9, within the sealing die 34 at the rear wall 34A thereof is a gassing stud 100 the lower end of which is mounted on the base 36. The upper end of this stud carries wire-like lateral extensions 102 to present a continuous elongate film support surface located outboard of the slit 104 made by the knife 70 as previously described. (Outboard in this context means on the side of the slit remote from the center of the package then in the sealing die.) This film support surface is level with the top of the die wall and thus holds the engaged part of film 14 in its normal position.

Just inboard of stud 100 is a vertically reciprocable pressure bar 106 formed with an interior passage 108 which provides an airflow channel, of relatively large cross section, leading down to a valve-controlled vacuum conduit (not shown herein) functionally similar to that disclosed in the above-identified copending application. The upper entrance to passage 108 is centrally aligned with the slit 104. Inboard of the pressure bar 106 is a flat plate 112 having a rectangular outline as seen in FIGURE 6, and presenting a smooth horizontal upper edge at a level below the flange portion of film 14 prior to the start of evacuation.

After the sealing die 34 has engaged the sealing clamp 42, vacuum is applied to the lower end of passage 108. The slit 104 thereupon opens, as illustrated in solid outline in FIGURE 8, while air flows out from the interior of the sealed package. Ordinarily, most of this air flows through passage 108, although some may flow down along the sides of the pressure bar 106. Also, it is possible to connect the lower end of the gassing stud to the evacuation system, so that some air can be withdrawn through that passage.

During exacuation, the film edge 14A inboard of the slit 104 will flex downwardly towards the pressure bar 106 a distance sufficient to provide an evacuation channel of substantial size into the interior of the package. However, the upper edge of plate 112 is located at a level to prevent this film edge from moving down and outwardly far enough

to overlap the opposite edge 14B. Thus the plate 112 prevents restriction of the flow of air out of the package which might otherwise result from such possible overlap. This plate 112 also protects the package from damage by the movement of the pressure bar.

After the package has been fully evacuated, the pressure bar 106 is shifted upwardly by means of actuator rods 114 and 116, as described in the above-identified copending application. The resilient top surface of the bar 106 presses the lower film 14 and the top film 118 together against a heated platen area 120 in the interior of the sealing clamp 42. The heat of the platen seals together the top film and the portions of the bottom film surrounding the slit 104 so as to effect a complete hermetic seal of the package.

With the film edge 14B supported effectively at the rear end wall 34A of the sealing die, there is provided a maximum range of positions of the slit 104 in which rapid evacuation can be acheved. Specifically, evacuation can be achieved if the slit is located anywhere between a point just outboard of the plate 112 to a point just inboard of the stud 100. This can be contrasted with the arrangement, disclosed in the above-identified copending application, where the range of slit positions was more sharply limited primarily because the pressure bar surrounded the gassing stud rather than being located wholly inboard of the stud as in the present arrangement.

The new construction avoids any need for unusually close tolerances on the slit position, and thereby relaxes the design and construction problems in other portions of the machine. It may be noted that although the gassing stud is shown as a separate part just inboard of the die wall, it is contemplated that in some instances it may be desirable to incorporate the gassing passages directly into the die wall and in such case the film can in effect be supported by the top surface of the die wall.

As shown particularly in FIGURE 7, adjacent both sides of the pressure bar 106 are horizontal resilient pads 130 and 132 which engage the lower film 14 to aid in keeping it from shifting during the evacuation and sealing operations. At the bottom of the die are three holes 134 which are connected to the vacuum conduit referred to above and serve to draw air from the sealing die 34 so as to equalize the inside and outside pressure on the package during evacuation.

When it is desired to change the package size, the forming and sealing dies are replaced with new dies of the new size. If the longitudinal package dimension is changed, the distance from the new forming die to the final seal station 32 ordinarily must be different from that existing previously, to provide an integral number of package "repeats" between the forming and sealing dies. In the machine disclosed in the above-identified copending application, this change in distance was effected by moving longitudinally the support bars to which was pivotally mounted the arms carrying the formers. In the present machine, the need for such an adjustment mechanism is eliminated by an arrangement wherein each of the various different-sized formers 18 or 20 is mounted on respective chassis plates, as illustrated at 136, adapted to be secured to the reciprocable pivoted arms 22 and 24.

In this new arrangement, the forming die parts are permanently secured and positioned on the respective chassis plate 136 at the correct place, for the package size involved, to provide an integral number of package "repeats" between the forming die and the final seal station 32. Thus the pivot point 26 of the arms 22 and 24 need not be moved for different formers. Some adjustment of each individual chassis plate 136 with respect to the arms 22 or 24 may be desirable, simply to account for normal manufacturing tolerances, and this facility is illustrated by set screws 140.

Once each chassis positioning is established for a given machine, there is no need thereafter to make any further adjustments whenever one chassis is replaced by another. Instead, the plate is simply installed on the corresponding arms in the location determined by the set screws 140 (previously adjusted to correct positions), and the plate then is bolted to the arms by captive screws 141 held in the plate 136 in oversize holes to permit alignment with the threaded bores in the arms.

Change of the longitudinal dimension of the package also requires a corresponding change in the positioning of the pneumatic actuator 60. For this purpose, referring to FIGURE 4, the actuator 60 is mounted on a part 140 which is secured to a channel member 142 slidably mounted on the bar 58. Clamp means are provided in the form of a knob 144 having a shaft 146 passing through bar 58 and threadedly engaged with channel member 142. In order to change the actuator location, knob 144 is rotated to release the clamp, the actuator then is moved to its new position, and the clamp is reset. Since the bar 48 remains essentially horizontal at all times, adjustment of the actuator position as described can be made without affecting clearances between the actuator and the packages during the indexing movements.

We claim:

1. In packaging apparatus of the type including a plurality of elements arranged for intermittent indexing movement around a closed path to support the opposite side edges of a continuous web of plastic film formed with a series of cups so that the cups are suspended in position to be operated on to make packages, said cups having marginal portions around the open mouths thereof with an evacuation opening in the marginal portion for each cup, each of said cups being adapted to be provided over the mouth thereof with packaging material to form a top for closing the cup; a package finishing station adjacent one index position on said path and including a die with wall means defining a cavity shaped to receive said cups, said wall means comprising side walls and end walls, a clamp operable with said die, said die and said clamp having seal means to engage said marginal portions of each cup, vacuum means adjacent the evacuation opening of the cup at said one position and operable to withdraw air from the sealed package before it is moved to another position; film support means at the one of said walls adjacent said evacuation opening adapted to support the film outboard of said opening during the evacuation of the package; a reciprocable pressure bar located inboard of said film support means and operable after the evacuation of said package to move against the film to permanently seal together the cup and its top around said evacuation opening, said pressure bar being formed to provide passages between said vacuum means and said evacuation opening to effect a rapid flow of air out of the package.

2. Apparatus as claimed in claim 1, wherein said pressure bar is in the form of a tube having a central passage free of obstructions and of substantial cross-section area to assure large air-carrying capacity, said film support means being located between said pressure bar and said one wall.

3. Apparatus as claimed in claim 2, wherein said one wall is an end wall of said sealing die, said pressure bar being located in an intermediate position between the side walls of said sealing die.

4. Apparatus as claimed in claim 1, wherein said film support surface forms part of a gassing element providing a passageway to communicate with said evacuation opening.

5. Apparatus as claimed in claim 1, including second film support means within said sealing die and adapted to engage the exterior surface of the film inboard of said pressure bar, said second film support being at a level below the top surface of said wall means to permit the film to flex down a distance sufficient to assure an evacuation channel of proper capacity with the interior of the package.

6. Apparatus as claimed in claim 5, wherein the level of both said first and second film support means is above

the level of said pressure bar during the evacuation operation, whereby the film edges on both sides of the evacua tion opening flex down towards the pressure bar to create an opening of substantial size adjacent said passages.

7. Apparatus as claimed in claim 6, wherein said second film support means comprises a thin plate mounted alongside of said pressure bar in a position parallel to the reciprocal movement of said pressure bar, the top edge of said plate presenting an elongate surface adapted to engage and support the inboard edge of film adjacent said evacuation opening.

8. In packaging apparatus of the type including a plurality of elements arranged for the intermittent indexing movement around a closed path to support the opposite side edges of a continuous web of plastic film formed with a series of cups, said cups having marginal portions around the open mouths thereof and being suspended from the film free of external support while being moved by said elements about said path; said apparatus comprising a package finishing station adjacent one index position on sid path and including a sealing die defining a cavity shaped to receive said cups, a clamp operable with said die, said die and said clamp having means to engage said marginal portions of each cup to hermetically seal the package during evacuation thereof; and a reciprocable support at a station just preceding said finishing station, said support being movable into and out of a position adjacent one marginal portion of a cup at the station, said support carrying an actuator including power-operated means to drive a knife at high speed through said one marginal film portion to make an evacuation slit therein during the dwell period between indexing movements of said film.

9. Apparatus as claimed in claim 8, wherein said actuator includes an element adapted to pass between two adjacent cups to engage and support the marginal portion of film to be pierced, said knife being mounted for reciprocating movement with respect to said element and normally positioned below the surface of said element which engages the film, said power-operated means serving to force said knife out from said element to pierce the film.

10. Apparatus as claimed in claim 9, including a frame positioned adjacent film and opposite said actuator, said frame presenting a support surface adapted to engage the film to restrain its movement when pierced by said knife.

11. Apparatus as claimed in claim 8, including a reciprocating base on which said sealing die is mounted for movement towards and away from said film, said actuator being connected to said base for reciprocating movement therewith.

12. Apparatus as claimed in claim 11, including a pivotally-mounted arm for reciprocating said base, said actuator being located closer to the pivot axis of said arm than said base; and means connected to said actuator for augmenting its reciprocating motion so that the actuator moves a distance substantially equal to that moved by said base, thereby to avoid interfering with indexing movement of said cups.

13. In packaging apparatus of the type having a plurality of elements arranged for intermittent indexing movement around a closed path to support the opposite side edges of a continuous web of plastic film and wherein there is at least one former adjacent said path adapted to be reciprocated towards and away from said film, said former including a forming die arranged to stretch the film into cup shape so that the film comprises a series of cups having marginal portions around the open mouths thereof and suspended in position to be operated on to make packages; means for making an evacuation opening in a marginal portion of each cup; reciprocating means for moving said former towards and away from said film to make said cups; a package finishing station adjacent said path beyond said former and including a die defining a cavity shaped to receive said cups, a clamp operable with said die, said die and said clamp having seal means to engage said marginal portions of each cup; a chassis removably secured to said reciprocating means, said former being permanently mounted on said chassis in a position to provide an integral number of package repeats between said former and said finishing station, whereby said chassis and its former can be replaced as an entity by another chassis and former of different package dimensions but correctly located to provide an integral number of package repeats for the respective package dimension, said reciprocating means comprising a pair of pivoted arms mounted side-by-side, said chassis comprising a plate spanning said arms and removably fastened thereto; and trim adjustment means providing an engagement between said plate and said arms to correctly locate the plate in position before the plate is fastened to said arms.

14. In packaging apparatus of the type having a plurality of elements aranged for intermittent indexing movement around a closed path to support the opposite side edges of a continuous web of plastic film and wherein there is at least one former adjacent said path adapted to be reciprocated towards and away from said film, said former including a forming die arranged to stretch the film into cup shape so that the film comprises a series of cups having marginal portions around the open mouths thereof and suspended in position to be operated on to make packages; reciprocating means for moving said former towards and away from said film to make said cups; a package finishing station adjacent said path beyond said former and including a die defining a cavity shaped to receive said cups, said finishing station including means to evacuate and seal each cup; a chassis removably secured to said reciprocating means to support said former; first fastening means on said reciprocating means; second fastening means on said chassis engageable with said first fastening means to position the forming die cavity in a predetermined position longitudinally of said film path; adjustable locating means on said chassis and operable with corresponding means on said reciprocating means to effect small changes in the longitudinal position of said forming die cavity so as to permit the chassis to be permanently adjusted at a pre-fixed location with respect to said reciprocating means to provide an integral number of package repeats between said former die and said sealing die, whereby any chassis and its former can be replaced as an entity by another pre-adjusted chassis with a former of different longitudinal package dimension and, when the engageable fastening means are secured, the former cavity will automatically be correctly located to provide an integral number of package repeats between the former die cavity and the sealing die cavity without requiring any longitudinal adjustment of any of the parts.

15. Apparatus as claimed in claim 14, wherein said adjustable locating means comprises set screw means on said chassis having a portion engageable with a corresponding element of said reciprocating means, whereby upon actuation of said set screw means said chassis is shifted longitudinally with respect to said reciprocating means.

References Cited

UNITED STATES PATENTS

3,303,628 2/1967 Louas et al. ---------- 53—22

TRAVIS S. McGEHEE, Primary Examiner