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W. J. McBRADY ET AL

3,283,469

METHOD AND APPARATUS FOR PRODUCING EVACUATED PACKAGES

Filed March 19, 1963

3 Sheets-Sheet 1

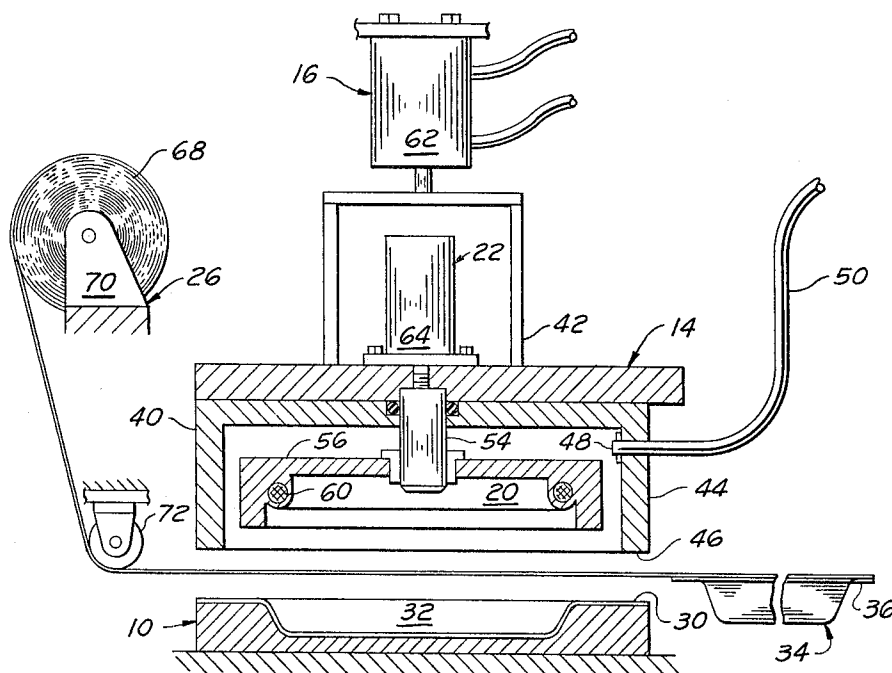


Fig - 1

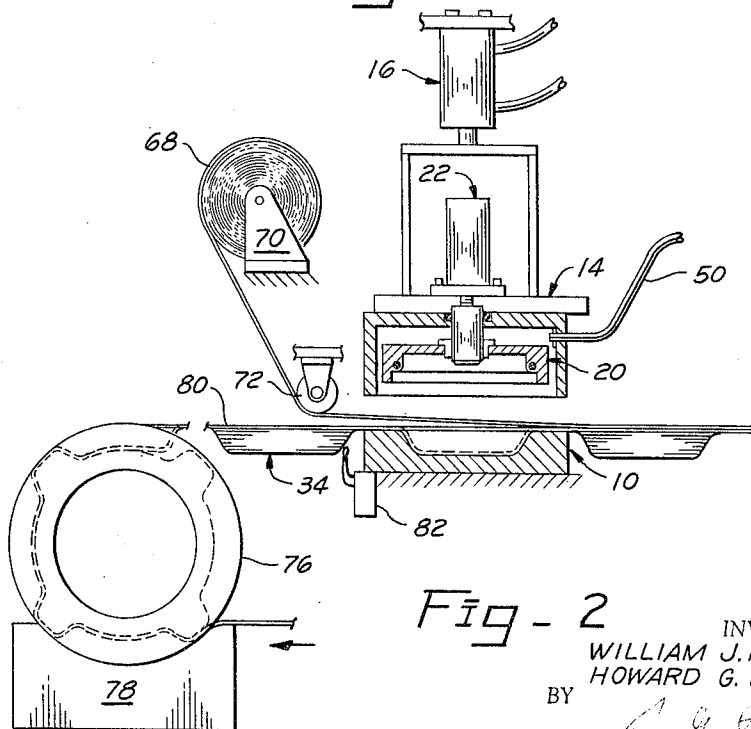


Fig - 2

INVENTORS.
WILLIAM J. McBRADY
HOWARD G. REICHEL

BY

C. G. Steen

ATTORNEY.

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W. J. McBRADY ETAL

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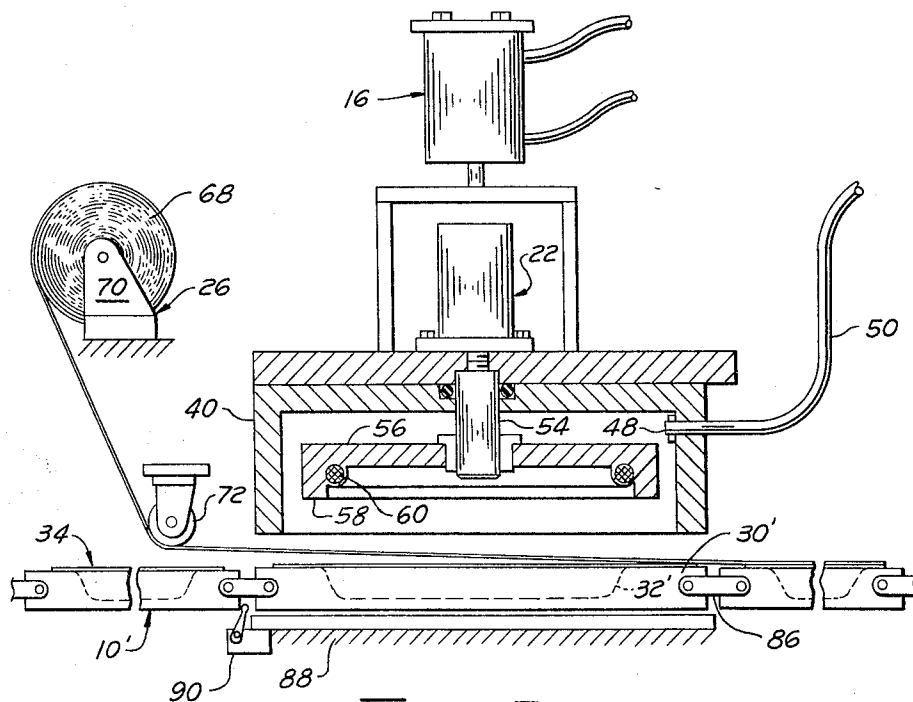


Fig. 3

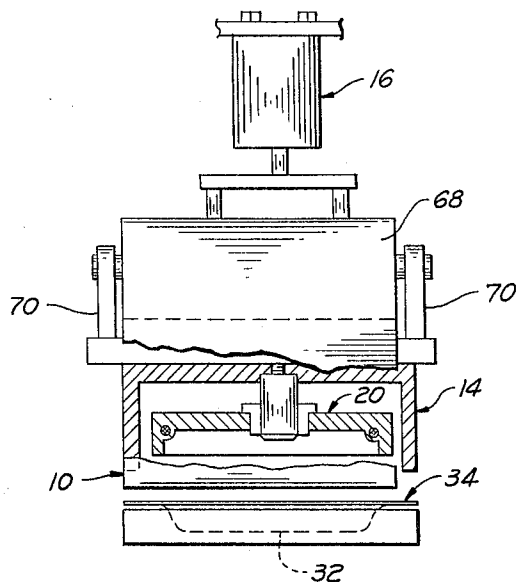


Fig. 4

INVENTOR.
WILLIAM J. McBRADY
HOWARD G. REICHEL
BY *R. G. Stone*
ATTORNEY.

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3 Sheets-Sheet 3

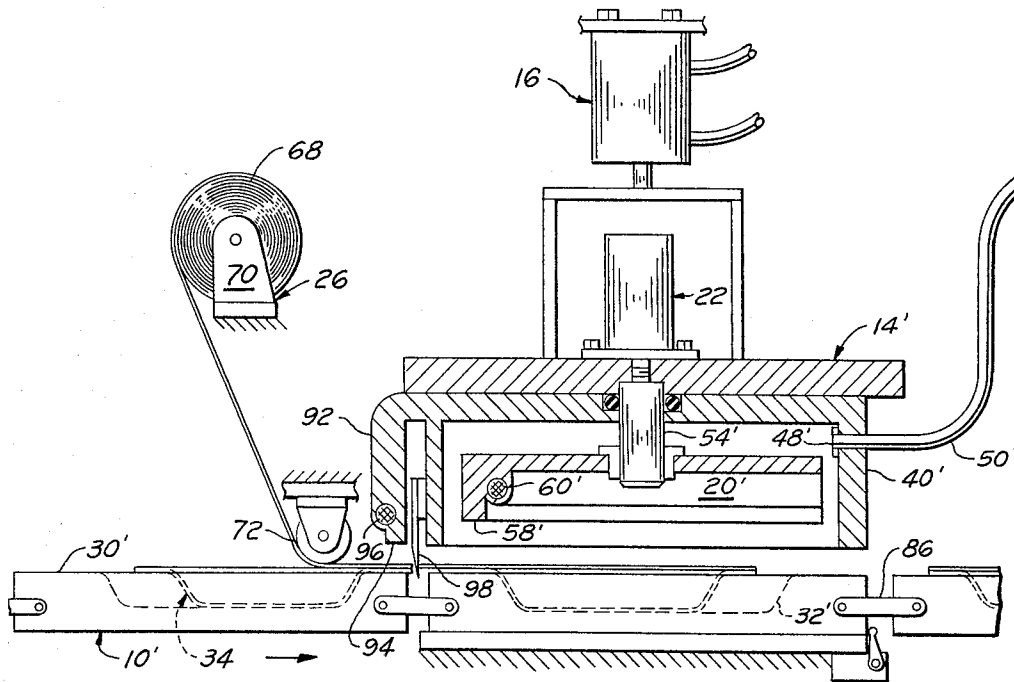


Fig. 5

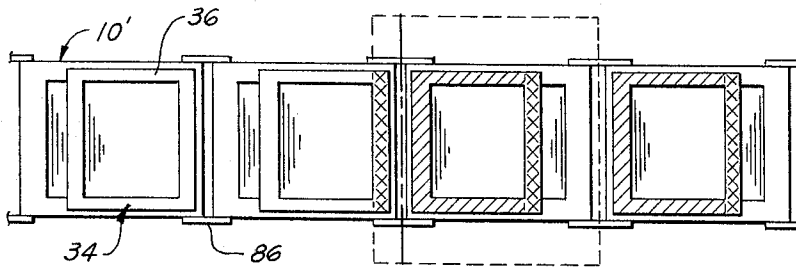


Fig. 6

INVENTORS.
WILLIAM J McBRADY
HOWARD G. REICHEL
BY
R. G. Stora
ATTORNEY.

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3,283,469

**METHOD AND APPARATUS FOR PRODUCING
EVACUATED PACKAGES**

William J. McBrady, Chicago, and Howard G. Reichel,
Western Springs, Ill., assignors to Swift & Company,
Chicago, Ill., a corporation of Illinois
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9 Claims. (Cl. 53-22)

This invention relates generally to the manufacture of closed packages from open top tray members containing product. More specifically, the present invention comprises an improved method and apparatus devised for both automatic and semiautomatic sealing of a closure film to the upper portion of a tray containing product, with provision for evacuating air from the tray space just prior to sealing.

By the terms "tray" and "tray members" is meant a product supporting member having side walls surrounding the space for product and outturned flanges or edges at the upper extremity of the side walls to which a closure film may be sealed. The outturned edges reside in one or more planes substantially perpendicular to the side walls and spaced from the bottom or product supporting surface of the tray. Such edges of a tray, therefore, may be curved or warped; but for purposes of illustration herein, trays having coplanar outturned edges parallel to the tray bottom are described.

This type of package has attracted increasing interest due to the ease with which the tray member may be produced at relatively low cost. However, for the most part, it has been necessary to completely overwrap a film about the entire outside of a tray and contents due to the commercial lack of adequate methods and equipment for accurately sealing a cover film to the top edges of a tray.

Accordingly, it is the primary object of this invention to provide an improved method and apparatus for sealing a top closure film to the upper edges of a tray type product supporting member.

It is another object of the present invention to provide an improved method and apparatus for evacuating a tray member supporting product and thereafter sealing a closure film to the tray.

It is a further object of the present invention to provide an improved method and apparatus for sealing a closure film to an open top tray which is adaptable to both semiautomatic and fully automatic operation.

Basically the present invention involves the delivering and inserting of each tray member into a female anvil means which is shaped to receive the bottom and sides of the tray with the edges thereof resting on the upper surface of the anvil means, drawing a closure film across the tray after product is filled therein, sealing the closure film to the edges of the tray and subsequently removing the sealed package from the area where sealing was completed. Preferably the filled tray is evacuated while residing in the anvil means between the time that the closure film is drawn thereover and sealed. Also, it is preferable that the sealing be accomplished by adhering two thermoresponsive materials under heat and pressure.

The apparatus for carrying out the present method comprises at least one anvil means shaped to conform to the periphery and depth of a tray member, and a cooperating sealing means congruent with at least a portion of the peripheral edges of trays to be sealed. Also, a supply means for closure film is closely located so that film may be drawn between the sealing means and a tray on the anvil means. The sealing means is located to be movable vertically into engagement with the film and tray edges positioned on the upper surface of the anvil means to thereby join the two materials. Preferably the apparatus also includes a means to remove the completed package

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from beneath the sealing means and simultaneously draw a further portion of the film into position for sealing to a subsequent tray. Also, it is preferred that the apparatus include a means for evacuating the tray prior to the sealing of the film thereon.

Further objects and advantages of the present invention will become apparent from the following description when taken in conjunction with the drawings, wherein:

FIGURE 1 is a side elevation view of the basic device of the invention for semiautomatic operation;

FIGURE 2 is a side elevation view of the device of FIGURE 1 adapted for fully automatic operation including means to produce a continuous web of trays;

FIGURE 3 is a side elevation view, with parts removed, of a further embodiment for automatic operation including an endless series of anvil means;

FIGURE 4 is an end elevation view of the device of FIGURE 1;

FIGURE 5 is a side elevation view of a further embodiment of the automatic device of FIGURE 3 for handling trays for varying length; and

FIGURE 6 is a plan view, with parts removed, of the anvil means in the device of FIGURE 5 showing the position of trays therein and the sequence of sealing steps.

The trays utilized in practicing the present invention may be manufactured from many rigid or semirigid materials and may be formed, for example, by either molding or pressing. Cover films may be sealed to the outturned edges of such trays by crimping, or adhering, or the like. Both the material of the tray and cover film should provide such characteristics as are required by the product packaged therein. For example, in the packaging of food product, oxygen and moisture permeability are of primary concern.

In the art of packaging food product it is preferred that the seal between such a tray and cover film be achieved by heat bonding the film directly to the tray material. Since polyethylene plastics are satisfactorily heat sealable, trays and films of such material, or coated with polyethylene, are usually suitable. Suitable trays can be manufactured from high density polyethylene in thicknesses of 7 to 30 mils with about 20 mils being preferred. Trays manufactured of polypropylene or polyethylene-coated polystyrene are also satisfactory.

Suitable cover films include, for example, vinylethylene, polyethylene, "Saran" and laminates of two or more such materials and laminates of such films with a polyester film such as "Mylar." Laminates are preferred for the reason that several desired characteristics of strength, and impermeability and sealability are best obtained. Laminates including "Mylar" as the outer layer are most preferred. An example of the latter is a laminated film consisting of an upper or outer layer of ½ mil "Mylar" coated with .1 mil "Saran" and a lower 2 mil layer of polyethylene.

Semiautomatic practice of the present method may be undertaken in a device as shown in FIGURE 1 where a filled tray is first placed within an anvil means and a continuous web of top film is drawn across the tray and anvil means and beyond the latter. Thereafter a chamber means is brought about the anvil, tray and film and preferably the space within the chamber means, including the tray, is evacuated. If desired, this space may be backfilled immediately with a nondeleterious gas such as nitrogen or the like. Where the tray is to be evacuated and/or backfilled it is desirable, when drawing the film across the tray, to align the film along one side of the anvil means so as to be free of the chamber means at the opposite side. However, the film must overlap at least a portion of every edge of the tray. This insures an adequate opening through which the tray space may be

readily evacuated and/or backfilled, yet permits an uninterrupted seal between film and tray to be obtained.

Subsequently, while the tray is subjected to vacuum or in the presence of a backfilled gas, the entire unsealed periphery of the tray is joined to the cover film. Sealing of the film to the tray may be accomplished by crimping the two materials together under pressure. However, especially where the tray is evacuated and/or backfilled, it is preferable to heat seal the two materials together by means of the usual techniques based on either hot pressing or electrical impulse fusing.

After sealing of the package is completed the chamber is connected to atmospheric pressure and removed from the anvil, whereupon an operator removes the completed package by grasping a portion of film previously drawn beyond the anvil, and pulling the package from the anvil thereby. For ease of handling, the film is not cut adjacent the anvil but is utilized to remove subsequently formed packages in the same manner. Each time one package is removed from the anvil means, the top film will be drawn thereby across the next filled tray inserted in the anvil.

The method may be made fully automatic by supplying trays in the form of a continuous web of material wherein the side walls and bottom of each tray are formed at regular intervals in the web. A device for this practice is illustrated in FIGURE 2. Trays may be conveniently supplied in this manner by forming the trays in flat web stock on location. Where the tray stock is of heat-formable material, the trays may be manufactured simply by hot forming between a die and mold while drawing the web of material through a packaging line.

Where the trays are supplied in a continuous web, the web is drawn intermittently through stations whereat the various packaging steps are completed. Each tray is first filled and is next drawn into the aforementioned anvil means. Thereafter the steps of the method are identical with the above-described semiautomatic operation. Upon opening of the chamber, however, both the top film and the web of trays are drawn from the anvil means a distance equal to the regular interval in which such trays are formed, and thus the next tray in line is automatically positioned in the anvil means beneath the top closure film.

A modified embodiment for automatically practicing the foregoing method involves the use of separate and individual trays wherein each tray is placed in an individual anvil means and undergoes the preceding steps. A device for practicing the latter method is illustrated in FIGURE 3. In this embodiment of the method a plurality of anvils, each being closely shaped to receive the bottom and side of the trays, are connected in endless alignment and are advanced through the identical steps disclosed with regard to an endless web of trays. A continuous string of packages interconnected by the cover film will result.

A further modification of the last mentioned automatic method results in the production of unconnected packages in which the trays may vary in length. FIGURES 5 and 6 illustrate a device for practicing the latter method. In this method, separate trays are inserted in successive anvil means which are connected in endless alignment. However, the trays may be the same or shorter in length than the anvil means measured in the direction in which the latter are movable. The trays may be filled before or after being inserted in the respective anvil means, but in either instance, each tray is placed against the forward limit of the anvil means.

Subsequently a top closure film is drawn in the same direction of motion across the forwardmost transverse edge of the tray and anvil means. The film is then sealed to the forwardmost edge of the tray. Thereafter when the anvil means is moved forwardly the tray is retarded, preferably due to drag imparted by the continuous film, which may conveniently be drawn from a roll. As the rear limit of the anvil means engages the tray side wall,

the tray, and film sealed thereto, will be advanced and the film drawn across the remainder of the tray. Then the film is sealed to the remaining edges of the tray including the rearmost edge. Simultaneously the closure film is also sealed to the forwardmost edge of the next tray, as above described; and the cover film extending between the two trays must be severed, except where the second tray is the full length of the anvil means.

If it is desired, as is preferred, to evacuate and/or backfill the trays during the last described embodiment of the method, such a step is undertaken after the film is drawn across the full length of a tray and before it is sealed thereto.

It is also to be understood that in the practice of the present invention, a tray may comprise one or more compartments within the aforementioned peripheral edges of the major tray unit; and a cover film may be sealed to such a compartmented unit along the division between compartments in addition to the peripheral edges. Consequently, upon finally severing the resultant packages, one or more such packages may be folded together to make a complex unit of product which will be held together at least by an interconnecting web of closure film.

Apparatus for carrying out the embodiments of the present invention comprise, in cooperative relation, an anvil means generally 10; a chamber means generally 14, and a reciprocable power means generally 16, therefore; a sealing means generally 20, and a reciprocable power means generally 22 for the latter; and a supply means generally 26 for top closure film. As is apparent from FIGURES 1 through 5, all embodiments of the device include those elements and, additionally, a power means (not shown) for moving trays in a path beneath the chamber means 14 and sealing means 20. In so far as the various embodiments include substantially identical elements of structure, such elements will be identified by the same reference characters throughout the various figures; whereas modifications of similar elements will be identified by the same reference character bearing a prime exponent.

Each anvil means generally 10 comprises a female shaped member having a peripheral rim 30 enclosing a cavity or depression 32 which is of a shape and size to receive the bottom and side walls of a tray, shown generally at 34, with the peripheral edges 36 of the tray resting on the top of the anvil rim 30.

The chamber means generally 14 comprises an inverted vessel 40 secured to a reciprocable frame 42 directly above the location of an anvil generally 10. The frame 42 is in turn connected to the power means generally 16. The vessel 40 includes a vertically extending peripheral enclosure wall 44 having a lower rim 46 which is congruent with the outer portion of the upper surface of rim 30 of the anvil 20. Preferably the vessel may be evacuated and/or backfilled through a gas port 48 located on its inner surface. The gas port 48 is connected by a hose 50 to suitable valving and sources of vacuum and filling gas, not shown. The rim 46 of the vessel 40 may conveniently be provided with a resilient surface of rubber or the like, not shown, to enhance contact with the anvil rim 30.

The sealing means generally 20 is reciprocably mounted within the vessel 40 and normally held at a lifted position by a connecting rod 54 extending from its power means generally 22. Suitable packing such as an O ring or the like surrounds the connecting rod at the horizontal wall of the vessel 40 to form a substantially airtight seal.

The sealing member itself includes a ring member 56 which accurately corresponds to the shape of the peripheral edge 36 of a tray 34 and generally to the inner portion of the anvil rim 30. The lower face of the ring 56 is formed of a heat conductor 58. A heating element 60, such as a resistance wire, is mounted about the heat conductor 58 following the shape of the ring member 56. The element 60 is connected to a source of electrical power, not shown. It is sometimes preferable, particu-

larly when sealing films having relatively low thinning or melting points, to attach a permanent barrier film (not shown) to the lower surface of the heat conductor 58. A suitable material for this purpose is a fluorine hydrocarbon plastic such as that sold under the name "Teflon."

In operation the lower rim 46 of the chamber means generally 14 must be accurately reciprocated, by the power means generally 16, upon the anvil rim 30 for each tray to be evacuated and sealed. It is preferred that a pneumatic cylinder 62 be attached to the reciprocable frame 42 for this purpose. Suitable connections are provided to valving and a source of high pressure air, not shown. Similarly, a second pneumatic cylinder 64 is preferred as the power means 22 attached to the connecting rod 54 of the sealing means 20. The second cylinder is fixed with respect to the vessel 40 and also is provided with suitable connections and valving to the source of high pressure air, not shown. The operating sequence, which may be controlled either manually or by any suitable timing mechanism, is to first lower the vessel 40 upon a film and tray within an anvil generally 10 while holding the sealing ring member 56 spaced from the anvil rim 30 within the vessel. The vessel 40 is then connected with the source of vacuum and the space enclosed thereby is evacuated. Subsequently the ring member 56 is moved downwardly by the pneumatic cylinder 64 to press the heated conductor 58 against the film and tray edges 36.

Top closure film is supplied for the trays from the supply means generally 26 which is fixedly secured adjacent the chamber means 14. The film is in the form of a roll 68 rotatably supported between a pair of brackets 70 and trained below an idler roll 72 and across an anvil generally 10. In the embodiments of the device illustrated in the figures it is very desirable that the brackets 70 be so positioned, as may be best seen in FIGURE 4, that one edge of the film will be aligned with an edge of the anvil rim 30. The width of the film is maintained less than the width of an anvil, and thus it is insured that, when the vessel 40 is lowered onto the anvil, the enclosure wall rim 46 will not press upon the film at the opposite side of the anvil rim 30. Thus an opening will be maintained between the film and a tray seated in the anvil, through which the tray space may be evacuated. Also it will be noted that after the closure film is sealed to the initial tray to be closed the film will be automatically drawn across each succeeding tray upon removing a completed package from beneath the sealing means 20.

In FIGURE 1 an embodiment of the apparatus for processing individual trays is shown. In FIGURE 2 an embodiment of the apparatus for processing a continuous web of trays is illustrated. In both embodiments of FIGURES 1 and 2 the above described elements are substantially identical and the anvil means generally 10 are fixed with respect to chamber means 14 and sealing means 20.

In the embodiment illustrated in FIGURE 2 additional apparatus, shown schematically, comprising a forming drum 76 and a cooperating forming head 78 are utilized to produce a continuous web 80 of interconnected trays which may be fed continuously into the sealing apparatus. A sensing means such as a switch 82 is located adjacent the infeed side of the anvil 10 to detect one tray when the preceding tray is in the anvil and initiate operation of the device.

The further embodiment of the present apparatus shown in FIGURE 3 is a fully automatic device for closing and sealing individual and separate trays. The chamber means generally 14 and sealing means generally 20 remain substantially identical with the aforementioned embodiment and like parts are identified by the same reference characters as hereinbefore. However, a plurality of anvil means generally 10', each comprising a rim 30' and surrounding a cavity 32', are connected together in an endless alignment to form a chain of anvils by means of links 86 which are pivotally attached to the rear of each rim

and the front of the next rim. In the area beneath the vertically reciprocable vessel 40 and ring member 56 the anvils generally 10' successively slide across a backing plate 88 in the direction indicated by the arrow. A suitable drive chain, not shown, is connected to intermittently move the endless series of anvils 10' forward. A sensing means such as a switch 90 is placed in the path of the anvils 10' to detect the leading edge thereof upon reaching the point at which the anvil rim 30' will be aligned with the vessel rim 46. The switch 90 is connected to halt the anvils generally 10' at that point and commence the closing and sealing operations as above described.

A final embodiment of the present apparatus is shown in FIGURE 5; and a diagram illustrating the sealing operation of that device is shown in FIGURE 6. This apparatus utilizes anvil means generally 10' similar to that shown in the embodiment of FIGURE 3. However, the chamber means generally 14' and sealing means generally 20' are somewhat different. In the device illustrated in FIGURE 5 an additional sealing means 92, comprising a transversely disposed heat conductor 94 and heating element 96, are secured outwardly of the inverted vessel 40' at the inlet side of the device so as to be aligned with the forward portion of the rim 30' on the next anvil means 10' awaiting entry beneath the chamber means generally 14'. Thus when a tray 34' is being sealed by the sealing means generally 20' the forwardmost or leading edge of the next following tray will be joined to the top film.

A severing means such as a stationary knife edge 98 is mounted forwardly of the transverse sealing means 92 at a position to sever the top film between adjacent anvil means 10' when the chamber means 14' is lowered. Since the forwardmost edge of a package is thus sealed outside of the chamber means 14', the heat conductor 58' and heating element 60' of the main sealing means 20' corresponds only to the remaining edges of a tray. In the illustration of FIGURE 6 the edge of a rectangular tray to which film is first sealed by the sealing means 92 is cross-hatched, and the remaining edges sealed by the sealing means 20' are shaded by diagonal lines.

The device of FIGURE 5 is intended to be used with trays that are shorter than the cavity 32' in each anvil means 10'. The position of each tray within anvil means 10' at locations preceding, during, and following the sealing of the cover film thereto is also shown in FIGURE 6 and will be clear from the foregoing explanation of the method performed by this embodiment of the apparatus.

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

We claim:

1. An improved method for closing and sealing tray-type packages comprising: depositing pre-formed open top trays sequentially into an anvil means conforming to the periphery of said trays; moving said trays and said anvil means in a given direction; filling product in each of said open top trays upon each tray moving past a given point; drawing a film of top closure material across the product and trays and said anvil means in said direction so as to overlap the edges of said tray; sealing said closure film to the forwardmost edge of said tray and simultaneously severing the film forward of the seal; moving the tray in said anvil means further in said given direction and thereby drawing said closure film across the tray and anvil means; and then sealing the film to the remainder of said tray while simultaneously severing and sealing said film to the forwardmost edge of the next tray.

2. An improved method for closing and sealing tray type packages comprising: depositing pre-formed open topped trays sequentially into an endless series of aligned anvil means, said anvil means conforming to the shape of said trays and being longer than said trays in the

direction of alignment; moving said trays and said anvil means stepwise in a given direction in line with said alignment; filling product in each of said open trays upon each tray moving past a given point; drawing a film of top closure material across the product and a first tray and said anvil means in said given direction so as to overlap the forwardmost edge of said tray; sealing said film to the forwardmost edge of said first tray; severing the film just forward of said forwardmost edge from the preceding portion thereof simultaneously with said sealing; moving said anvil means containing the tray and film sealed thereto in said given direction while regarding the forward movement of said tray and film until the rear of said anvil means pushes said tray and film sealed thereto in said given direction, whereby said film is drawn across the remainder of said first tray and the forwardmost edge of the next tray; thereafter finally sealing the film to the rearmost and remaining edge of said first tray and simultaneously sealing the forwardmost edge of the next tray and severing the film between said trays; and moving said anvil means and trays further in said given direction.

3. The method of claim 2 wherein after drawing the film across the remainder of said first tray a chamber means is placed about said tray in contact with at least said anvil means so as to enclose a space about the product on said first tray and said closure film, and exhausting air from the chamber means and from about said product therein; and opening said chamber means after finally sealing the film to the rearmost and remaining edge of said first tray.

4. An improved apparatus for closing and sealing tray-type packages comprising: anvil means conforming to the periphery of said tray, said anvil means having a depression to receive said tray in a position resting the edges thereof on said anvil means; supply means for a top closure film positioned adjacent said anvil means, said supply means feeding film across said anvil means in a given direction; chamber means conforming to the outer portions of said anvil means positioned above said anvil means, said chamber means being reciprocable vertically for engagement with said anvil means; evacuating means connected to said chamber means to withdraw air therefrom; sealing means conforming to the periphery of said tray positioned in said chamber means, said sealing means being movable into engagement with the film and edges of a tray and said anvil means when said chamber means is closed upon the latter whereby to seal said film to said edges; and movable means associated with said anvil means to remove said film and a tray sealed thereto from beneath said sealing means and said chamber means in said direction.

5. The apparatus, according to claim 4, wherein one side of said supply means is aligned with an edge of said anvil means and is of such a width to leave a space between the opposite edge of the film and the adjacent portion of said chamber means when the latter is engaged with said anvil means.

6. An improved apparatus for closing and sealing tray-type packages comprising: anvil means conforming to the periphery of said tray, said anvil means having a depression to receive said tray in a position resting the edges thereof on said anvil; chamber means conforming to the outer portion of said anvil means positioned above said anvil means, said chamber means being reciprocable vertically for engagement with said anvil means; first supply means for a top closure film positioned at one end adjacent said anvil means, said supply means feeding film across said anvil means in a given direction, one side of said supply means being aligned with an edge of said anvil means and said film being of such a width to leave a space between the opposite edge of the film and the adjacent portion of said chamber means when the latter is in engagement with said anvil means; second supply means for a substantially continuous web of open

topped trays spaced beyond said one end and said first supply means for feeding said trays in said given direction to said anvil means beneath said first supply means and said top closure film; evacuating means connected to said chamber means to withdraw air therefrom; sealing means conforming to the periphery of said tray positioned within said chamber means, said sealing means being movable into engagement with the film and edges of a tray and said anvil means when said chamber means is closed upon the latter whereby to seal said film to said edges; and movable means associated with said anvil means for drawing said substantially continuous web of trays and films sealed thereto in said direction away from said anvil means.

7. An improved apparatus for closing and sealing tray-type packages comprising: a plurality of anvil means conforming to the periphery of a tray and having depressions therein to receive said tray in a position resting the edges of the tray on said anvil means, said anvil means being connected in endless alignment and trained for movement along a path in a given direction; a chamber means for providing an enclosure about the top of at least one of said anvil means positioned at a point above said path, said chamber means being reciprocable vertically for engagement with said anvil means; supply means for feeding a top closure film in said given direction between said anvil means and said chamber means, said supply means being positioned adjacent an end of said chamber means in the opposite of said direction, one side of said supply means being aligned with an edge of said anvil means and said film being of such a width to leave a space between opposite edge of the film and the adjacent portion of said chamber means when the latter is in engagement with an anvil means; evacuating means connected to said chamber to withdraw air therefrom; and sealing means for sealing said top closure film to the edges of a tray resting on an anvil means, said sealing means being reciprocably mounted within said chamber means for movement into contact with the said film and edges of a tray.

8. An improved apparatus for closing and sealing tray-type packages comprising: a plurality of elongated anvil means having depressions therein to receive trays in a position resting the forward edges of each tray on said anvil means, said anvil means being connected in endless alignment and trained for movement along a path in a given direction, said depressions therein generally conforming to the shape of a tray about three sides and being longer than a tray in said given direction; a chamber means for providing an enclosure about the top of a first one of said anvil means positioned at a point above said path, said chamber means being reciprocable vertically for engagement with said first anvil means; supply means for feeding a top closure film in said given direction between said anvil means and said chamber means, said supply means being positioned adjacent an end of said chamber means in the opposite of said direction; evacuating means connected to said chamber means to withdraw air therefrom; first sealing means for sealing said top closure film to the rearward edges of a tray resting on an anvil, said first sealing means being reciprocally mounted within said chamber means for movement into contact with the film and rear edges of a tray; second sealing means for sealing said top closure film to the forwardmost edge of a tray in the next anvil means following said first anvil means, said second sealing means being connected to one of said chamber means and said first sealing means; and severing means for cutting said top closure film between successive anvil means, said severing means being mounted adjacent, in said direction, said second sealing means on one of said chamber means and said first sealing means.

9. An improved apparatus for closing and sealing tray-type packages comprising: a plurality of elongated anvil means having depressions therein to receive trays in a

position resting the forward edges of each tray on said anvil means, said anvil means being connected in endless alignment and trained for movement along a path in a given direction, said depressions therein generally conforming to the shape of a tray about three sides and being longer than a tray in said given direction; a chamber means for providing an enclosure about the top of a first one of said anvil means positioned at a point above said path, said chamber means being reciprocable vertically for engagement with said first anvil means; supply means for feeding a top closure film in said given direction between said anvil means and said chamber means, said supply means being positioned adjacent an end of said chamber means in the opposite of said direction; first sealing means for sealing the top closure film to the rearward edges of a tray resting on an anvil, said first sealing means being reciprocally mounted within said chamber means for movement into contact with the film and rear edges of a tray; second sealing means for sealing said top closure film to the forwardmost edge

of a tray in the next anvil means following said first anvil means, said second sealing means being connected to one of said chamber means and said first sealing means; and severing means for cutting said top closure film between successive anvil means, said severing means being mounted adjacent, in said direction, said second sealing means on one of said chamber means and said first sealing means.

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TRAVIS S. McGEHEE, *Primary Examiner.*