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(54) **RELEASE-COATED PACKAGING TOOLING**

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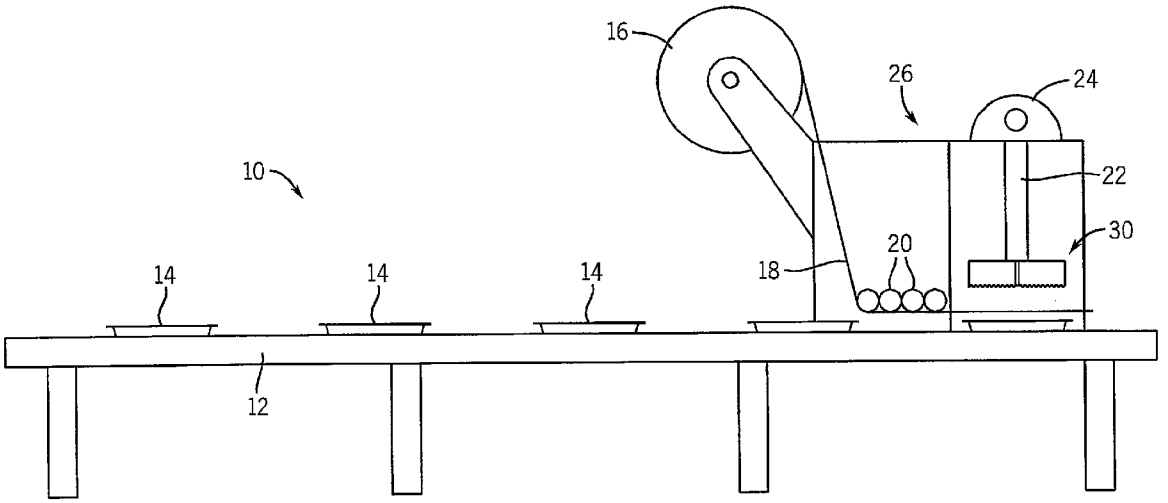
(57) **ABSTRACT**

Tooling for a tray-sealing machine is coated with an electroless metal release coating. The coating is applied over the surface of the severing knives and/or clamp of the tooling that is utilized with the tray-sealing machine that comes into contact with a lidding material film used by the machine and penetrates into the surface of the tooling to be integrally formed in the tooling. The coating prevents any of the lidding material film used in forming a cover on the tray from adhering to the knives or the clamp during operation of the machine.



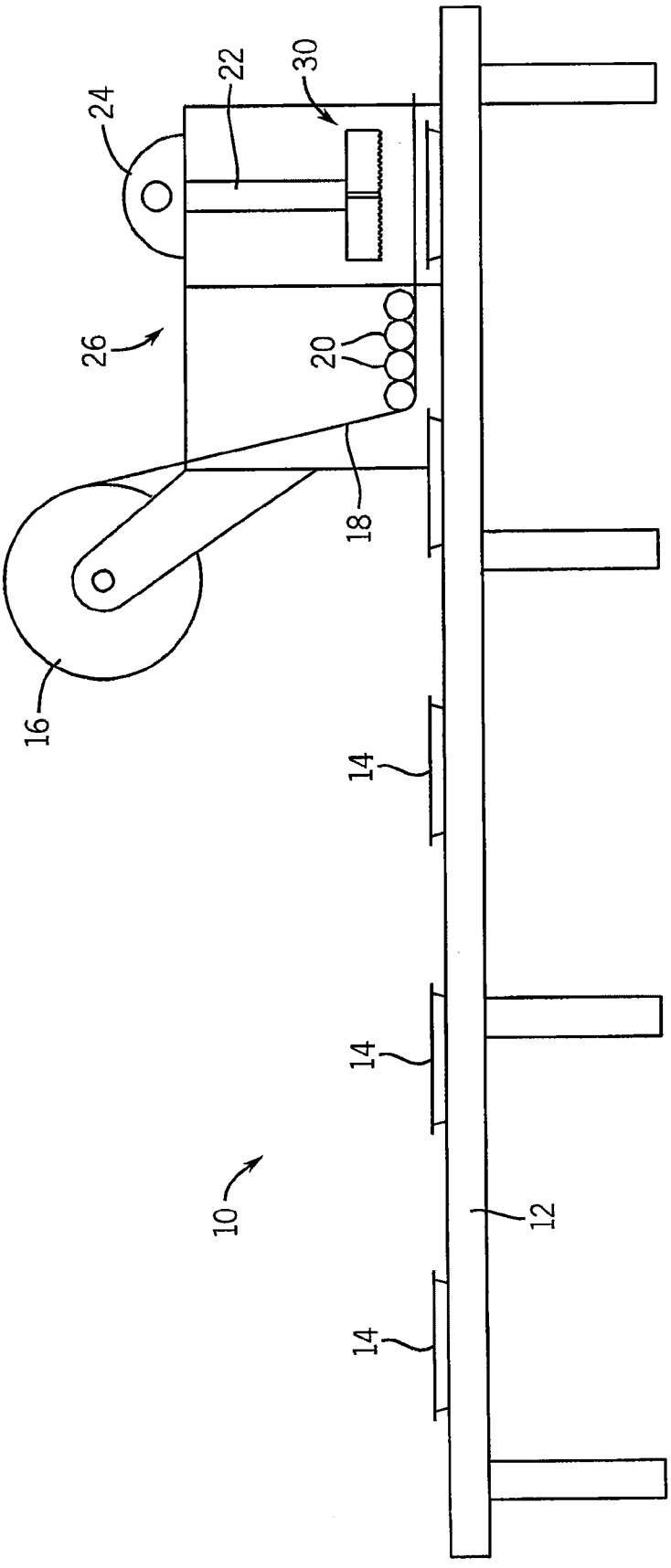


FIG. 1

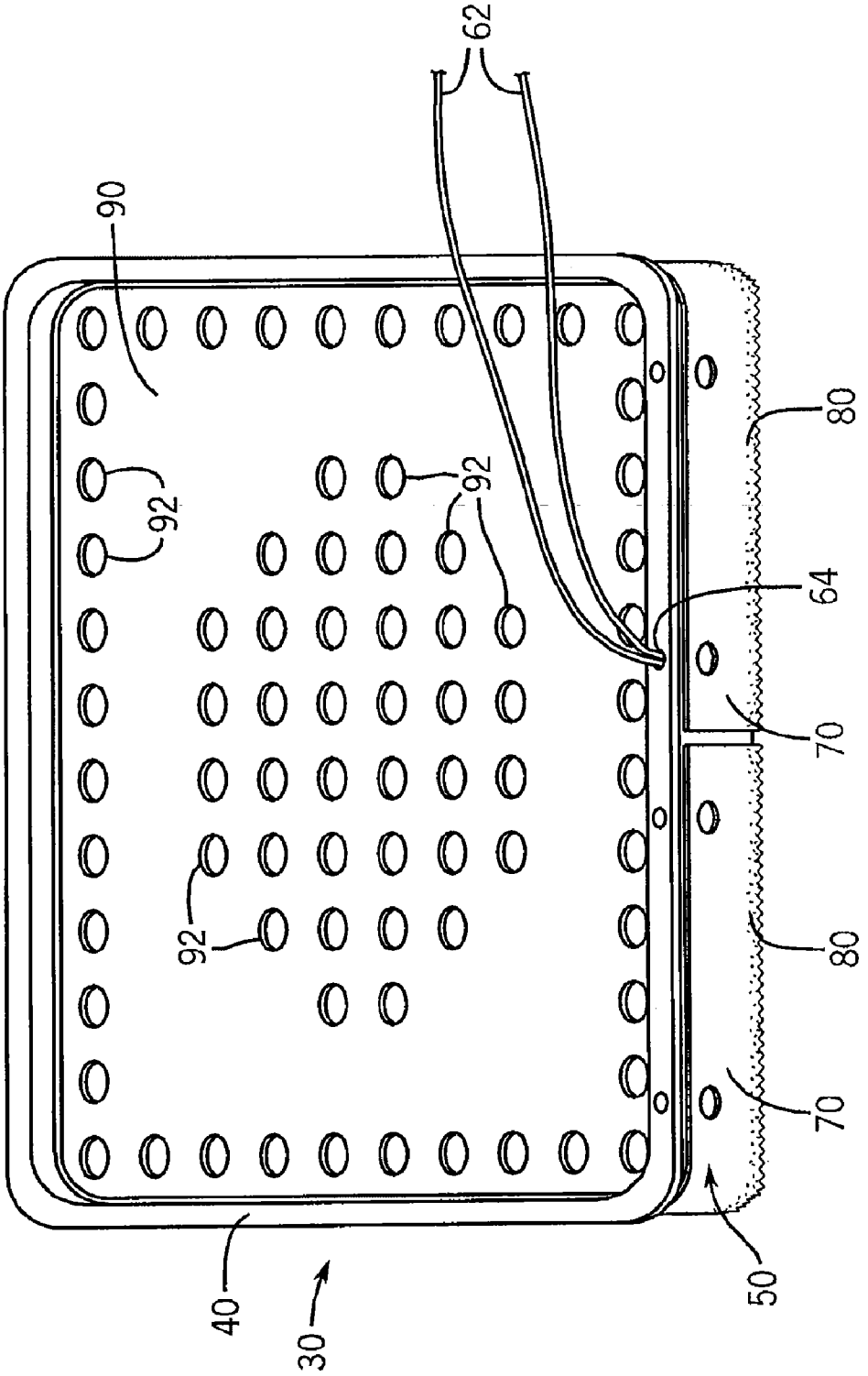


FIG. 2

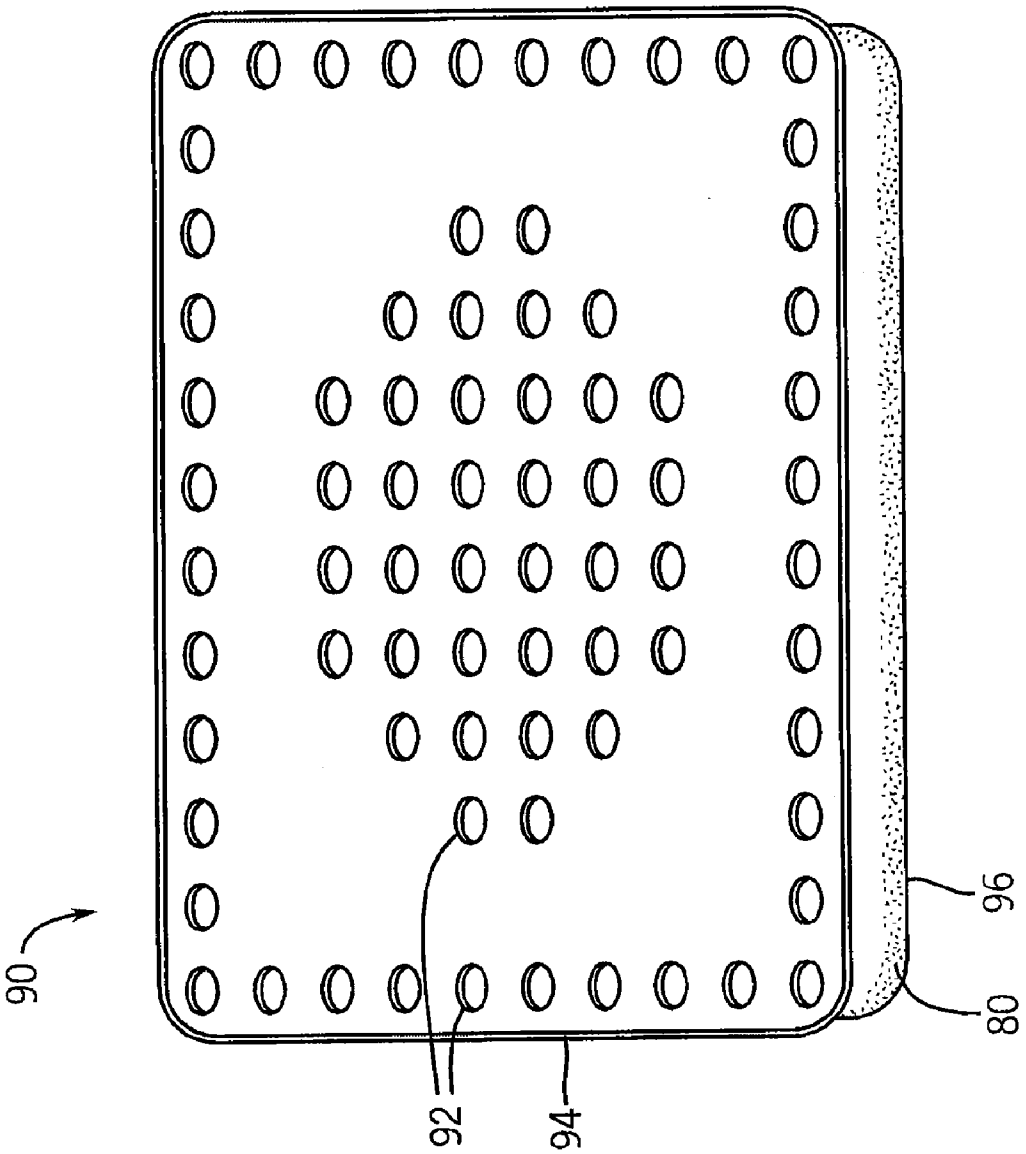


FIG. 3

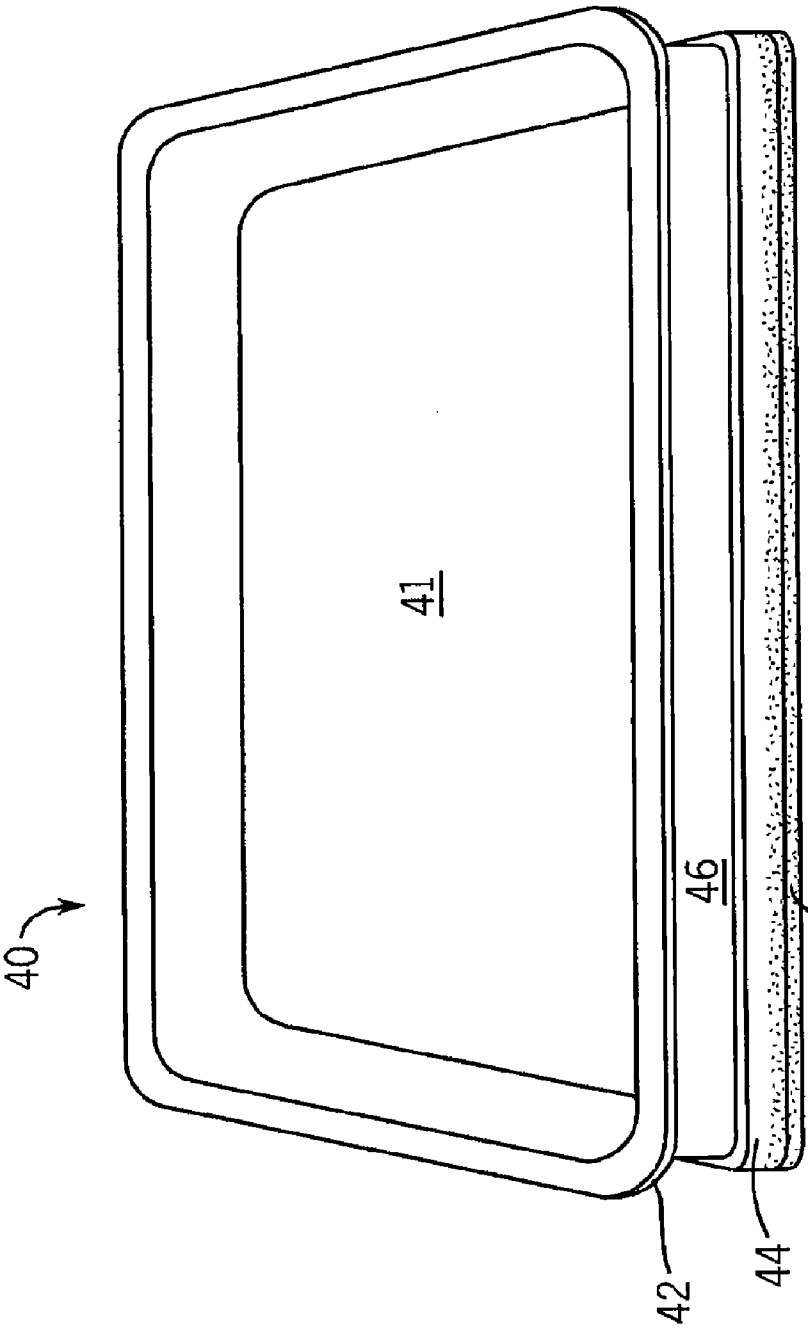


FIG. 4

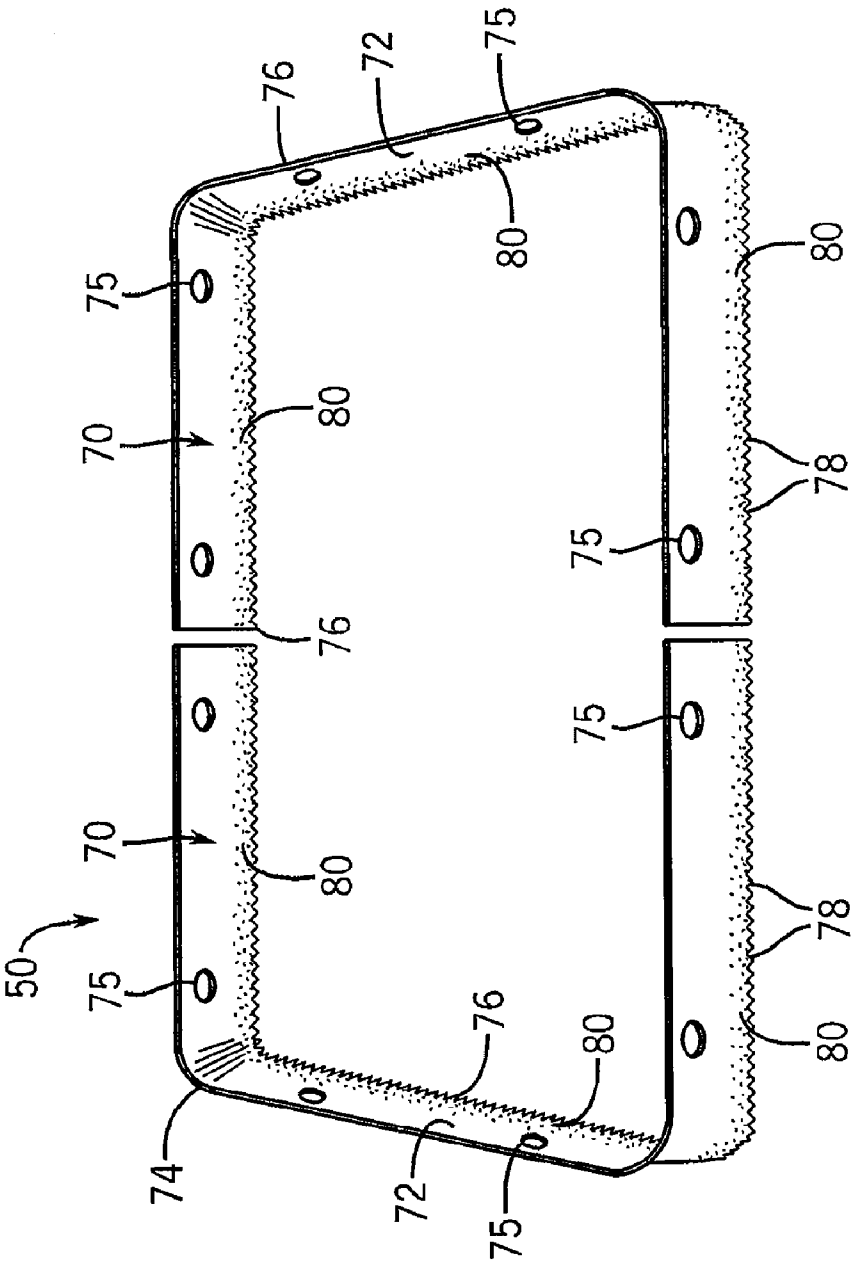


FIG. 5

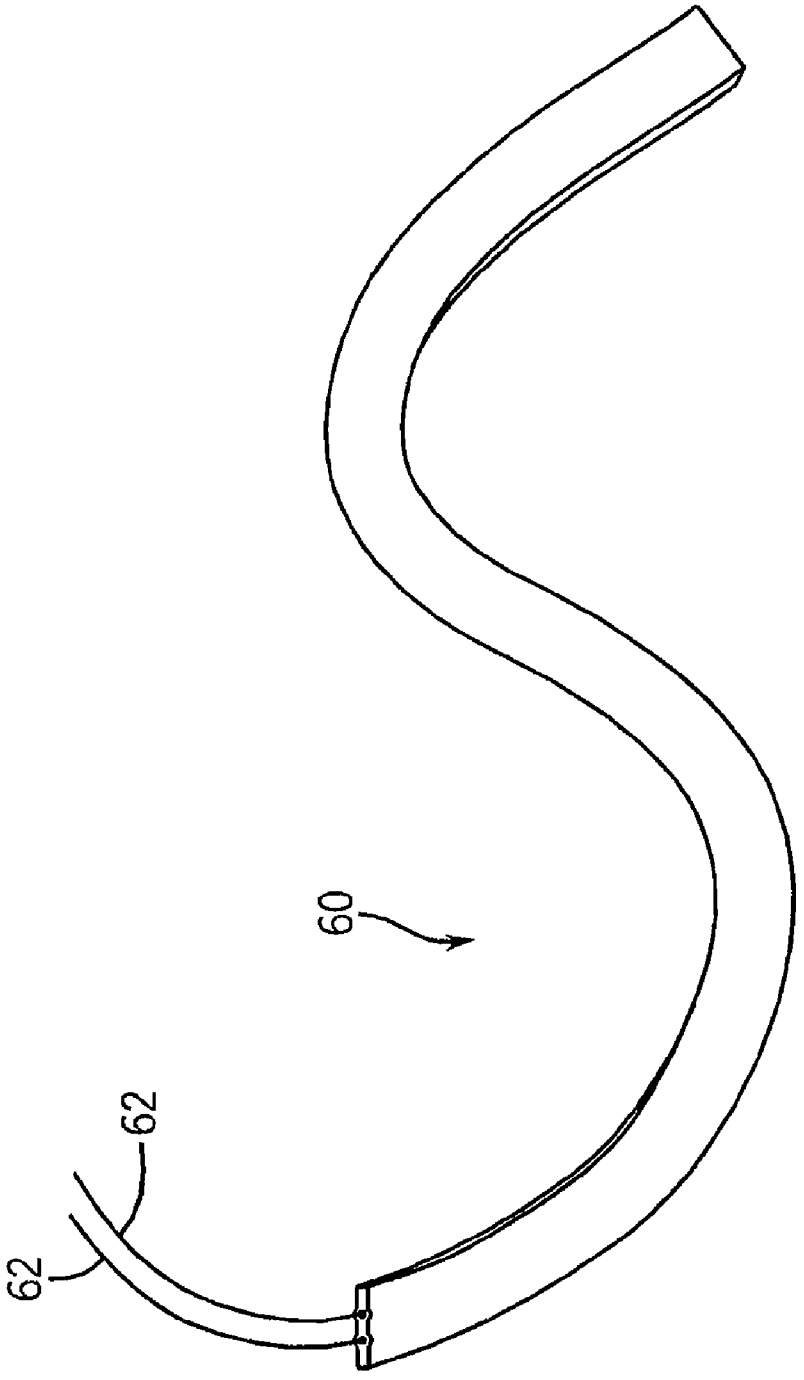


FIG. 6

RELEASE-COATED PACKAGING TOOLING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority as a continuation-in-part from U.S. Non-Provisional application Ser. No. 10/983,355, filed Nov. 8, 2004, which claims priority from U.S. Provisional Application Ser. No. 60/518,468 filed on Nov. 7, 2003.

FIELD OF THE INVENTION

[0002] The present invention relates to packaging tooling, and more specifically to tooling utilized to sever a thermoplastic web sealed to a tray containing a product to form a cover for the tray in which the tooling includes a release coating.

BACKGROUND OF THE INVENTION

[0003] In many industries, and in particular the food processing industry, often times products are packaged in formed plastic trays for sale to consumers. Most often, when products are packaged in trays of this type, the product is covered and retained within the tray by a cover formed of a thermoplastic or other lidding material secured to and around the periphery of the tray.

[0004] The products and covers are positioned within and/or around the trays in a continuous process utilizing tray-sealing machines, which are well known in the art. In these machines, as a tray that has been filled with a product moves towards a sealing station of the machine, a thermoplastic or other lidding material film is directed downwardly towards the tray to position and align the web over the open end of the tray. The film is then sealed against the periphery of the tray over the open end by a conventional sealing member or clamp, thereby properly forming the web as a cover over the tray. After the film is sealed against the tray, a heated knife is moved downwardly around the clamp to sever the lidding film around the periphery of the tray, completing the formation of the cover on the tray.

[0005] Due to the properties of the lidding materials utilized to form the cover film, when these films are contacted by the heated knife, the heat of the knife causes the film to soften and/or melt at the point of contact with the knife, making it easier to sever the film at the desired location. However, heating the film with the knife to melt the film also causes the melted film to adhere to the knife, which is typically formed of a metal. Over time, the buildup of the melted film material on the knife causes the knife to lose its ability to sever the film cleanly around the tray, resulting in irregular or defective covers on the trays. Thus, the knives need to be cleaned at regular intervals in order to maintain the proper formation of the covers on the trays by the knives. This problem of film buildup also occurs on the clamp and other parts of the packaging machine for the same reasons, necessitating cleaning of these parts of the tooling as well. The time and effort required for this cleaning and the loss of production time for the machine are highly undesirable.

[0006] As a result, it is desirable to develop a packaging machine and tooling therefore which is capable of greatly reducing and/or eliminating the build up of lidding film material on the tooling in order to enable the machine to run continuously for an extended period of time without having to stop the machine to remove any build up of the lidding film from the tooling. It is also desirable that the packaging machine tooling be formed such that any build up of lidding film on the tooling can be more easily removed, greatly reducing the time needed to remove any film build up on the tooling, and thus reducing the downtime for the machine.

SUMMARY OF THE INVENTION

[0007] According to a primary aspect of the present invention, the severing tooling for a packaging machine is formed with an electroless metal coating deposited on the exterior surface of the tooling. These types of coatings are often used on wear parts due to their significant wear resistance properties. However, these types of coatings have also been shown to unexpectedly function as a non-stick or release layer on the severing tooling to substantially reduce the adherence of any lidding film materials to the tooling, consequently greatly reducing the formation of any film build up on the tooling. The electroless metal coating formed on the tooling does not affect the ability of the tooling to be heated, specifically the knife utilized to sever the thermoplastic film around the periphery of the tray, while providing the release properties to the knife. When using tooling that has been coated in this manner, the length of time that a packaging machine can be run continuously before any cleaning of the tooling of the machine is required is increased significantly compared to non-coated tooling. Furthermore, because the release layer enables any lidding film buildup which has occurred on the tooling to be more easily removed when necessary, the useful life of the tooling is also greatly extended, while the downtime of the machine required when cleaning the tooling is greatly reduced.

[0008] According to another aspect of the present invention, the release coating or layer can be applied to the tooling in a manner which evenly covers the tooling to maintain the proper tolerances between the different parts of the tooling. Specifically, the material utilized in and thickness required for the coating to be effective as a release layer can be applied to be sufficiently thin as to prevent different portions of the tooling from coming into contact with one another while the tooling is in use.

[0009] According to still another aspect of the present invention, the coating material utilized can be applied to the to the tooling in a manner that integrates the coating material within the material forming the tooling, such that the coating does not constitute a separate layer on the exterior surface of the tooling, but essentially changes the attributes of the material to provide a release attribute to the surface of the tooling material.

[0010] Numerous other features, advantages and aspects of the present invention will be made apparent from the following detailed description taken together with the drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The drawings illustrate the best mode currently contemplated of practicing the present invention.

[0012] In the drawings:

[0013] FIG. **1** is a side plan view of a tray sealing machine utilizing severing tooling including the release coating of the present invention;

[0014] FIG. **2** is a perspective view of the tooling of FIG. **1**;

[0015] FIG. **3** is a side perspective view of a clamp used in the tooling of FIG. **1**;

[0016] FIG. **4** is a top perspective view a knife ring used in the tooling of FIG. **1**;

[0017] FIG. **5** is a perspective view of a knife set used in the tooling of FIG. **1**; and

[0018] FIG. **6** is an isometric view of a strip heater used in the tooling of FIG. **1**.

DETAILED DESCRIPTION OF THE DRAWINGS

[0019] With reference now to the drawing figures in which like reference numerals designate like parts throughout the disclosure, a tray sealing machine is illustrated generally at **10** in FIG. **1**. The machine **10** includes a conveyor **12** on which a number of trays **14** filled with a product (not shown) move towards a sealing station **26**. The sealing station **26** includes a roll **16** of a suitable lidding material **18** that is directed from the roll **16** over the trays **14** by rollers **20**. The film **18** from the roll **16** is sealed to the trays **14** and separated from the remainder of the roll **16** by tooling **30** movably attached to the station **26**, such as by a vertically moving piston **22** operate in conjunction with the conveyor **12** by a motor **24**, for example. The machine **10** on which the tooling **30** is utilized can be any type of sealing machine that may also provide other functions, such as forming the tray **14**, or filling the tray **14** with a product. Suitable machines that have these capabilities and with which the tooling **30** of the present invention can be utilized include machines sold by Ross Industries, of Midland, Va., G. Mondini S.P.A. of Cologne, Italy, Koch Equipment LLC, of Kansas City, Mo., and Ulma Packaging of Onati, Spain, among others.

[0020] Referring now to FIGS. **2-6**, the tooling **30** includes a knife ring **40**, a knife set **50**, a strip heater **60**, and a clamp **90**. The knife set **50**, as best shown in FIGS. **2** and **5**, is formed of a pair of knives **70**. Each knife **70** has a generally rectangular shape corresponding to the shape of the tray **14** to which the film or barrier lidding material **18** is to be secured by the machine **10**, but can have any shape desired depending upon the particular configuration for the tray **14**. Each knife **70** is formed with a peripheral wall **72** having an upper end **74** and a lower end **76**. The upper end **74** includes a member of spaced apertures **75** used to secure the knives to the knife ring **40**. The lower end **76** is formed with a number of teeth or serrations **78** along the entire length of the lower end **76** in order to enable the knife **70** to more easily sever the lidding material **17** upon contact of the lower end **76** of the knife **70** with the lidding material **17**.

[0021] Each knife **70** is preferably formed of a rigid material, such as a metal, and more preferably stainless steel, which is strong and durable enough to withstand the normal use and wear generated by use of the knives **70** on a tray sealing machine **10**, and that can also be heated in a closely controllable fashion. The knife **70** also includes a release coating **80** applied over the entire interior and exterior surface of the knife **70**. The coating **80** is an electroless metal coating, such as an electroless nickel, copper, gold, palladium, cobalt, silver or tin coating that can be deposited on the surfaces of the knife **70** in any suitable or conventional manner for applying coating of this type, such as the manner disclosed in Henry et al. U.S. Pat. No. 4,830,889, which is incorporated herein by reference. The coating **80** provides a number of well-known advantageous properties to the knives **70**, including uniformity over the coated item to a ±0.0001"/side thickness; excellent corrosion resistance; wear and abrasion resistance; non-magnetic and magnetic properties; solderability; high hardness; amphorous (microcrystalline) deposit; excellent adhesion; low coefficient of friction; high reflectivity; EM/RFI shielding; preplate for precious metal plating; heavy deposits; and deposits onto wide range of metallics and non-metallics.

[0022] Further, in addition to these beneficial properties provided by coatings of this type that are observed when the coatings are deposited on wear parts as discussed in the Henry et al. '889 patent, unexpectedly, the coating **80**, when utilized on the knives **70**, also functions as a highly effective release layer for the knives **70**. This result is unexpected in that the knives **70** are heated to enable each knife **70** to more easily and quickly sever the lidding material **18** during operation of the sealing machine. The lidding material **18** is normally a plastic material, such as a polyethylene, that melts when contacted by the heated knives **70**. Thus, the melted portions of the lidding material **18** in contact with the knives **70** previously became adhered to the knives **70**, necessitating the cleaning of the knives **70** to remove this buildup of the material **18** on a very frequent basis. However, after applying the coating **80** to the knives **70**, the coated knives **70** are heated and moved into contact with the lidding material film **18** to sever the film **18** around the tray **14**, and the coating **80** prevents the lidding material **18** that has been melted or softened by contact with the knives **70** from adhering to the knives **70**. Thus, because the material **18** does not adhere well to the knives **70**, this prevents the cover formed by the material **18** from being malformed by the attachment of the material **18** forming the cover to the moving knives **70**. Also, any lidding material **18** that does remain on the knives **70** is also easily removable from the knives **70** due to the release properties of the coating **80**.

[0023] Alternatively, the coating **80** can be applied to the knives **70** in a manner that allows the coating **80** to become part of the knives **80** as opposed to a separate layer disposed on the exterior surfaces of the knives **70**. In particular, the coating **80** can be formed on the knives **70** using a process that integrates the composition forming the coating **80** directly into the material forming the knives **70**. Examples of coatings **80** of this type include Endura 100R-V and Endura 203X3-CR coatings, sold by Endura Coatings of Sterling Heights, Mich.

[0024] In the application of coatings **80** of this type, especially to knives **70** formed from aluminum, initially the surface of the knives **70** are converted from aluminum to aluminum oxide using an electrochemical process. In this process, the crystals of aluminum increase in size, thereby creating a porous matrix of ceramic. This matrix is then sealed over a predetermined period of time with an infusion of <1 micron-sized fluoropolymers that provide the surface of the aluminum material with a low friction property. The fluoropolymer particles are also stable at high temperatures, meaning the coating **80** formed utilizing the particles is able to be utilized on components that are employed in high temperature processes. Upon curing, the fluoropolymers cause the low friction property to remain on the surface of the knife **70**, such that the knife **70** resists build up of any lidding material **18** thereon, and also enables any material **18** sticking to the knife **70** to be easily removed.

[0025] For knives **70** formed of materials other than aluminum, to apply the coating **80** the knife **70** initially has a metal, and preferably a nickel alloy plated onto the exterior surface of the knife **70** to form a porous layer on the exterior of the knife **70**. The nickel alloy layer is subsequently sealed with

the infusion of <1 micron-sized fluoropolymers that provide the surface of the knife **70** with a low friction property.

[0026] The particular fluoropolymers and/or duration are selected based on the material forming the knives **70** and the desired performance factors for the coating **80**.

[0027] In addition to the knives **70**, the coating **80** also can be utilized in a similarly beneficial manner on the other components of the tooling **30**. For example, the knives **70** of the knife set **50** are disposed on the knife ring **40**, best shown in FIGS. **2** and **4**. The knife ring **40** is also formed of a metal, and preferably aluminum, and can have any shape that defines an open interior **41** conforming to the configuration of the tray **14** formed by or used in the particular tray-sealing machine. Preferably, the knife ring **40** is rectangular in shape with a peripheral rim **42** at one end and a ridge **44** spaced from the rim **42** to define a channel **46** therebetween. Each knife **70** of the knife set **50** is positioned against the rim **42** and held outwardly from the ring **40** by the ridge **44** to position the lower end **76** and serrations **78** of each knife **70** below the knife ring **40** such that the lower end **76** of each knife **70** properly contacts the lidding material film **18**. Because the ridge **44** of the knife ring **40** is positioned adjacent the lower end **76** of each knife **70**, the application of the coating **80** to the knife ring **40** also prevents any lidding material **18** softened or melted by the knives **70** from adhering to the knife ring **40**. Also, the particular coating **80** applied to the knife ring **40** can be the same electroless metal coating used on the knives **70**, or can be an electroless coating formed with a different metal applied in a similar or different process, or a coating **80** formed as a part of the material that comprises the knife ring **40**.

[0028] In order to properly heat the knives **70** in order to soften and sever the film **18**, the tooling **30** also includes a strip heater **60** best shown in FIGS. **1** and **6**. The heater **60** includes a pair of leads **62** which extend outwardly from the heater **60** and through an aligned opening **64** in the knife ring **40** for connection to a power source (not shown) on the machine **10** to operate the heater **60**. The heater **60** is positioned within the channel **46** on the knife ring **40** between the knife ring **40** and the knives **70** of the knife set **50** such that the heat generated by the heater **60** also heats the knife set **50** and knife ring **40**.

[0029] Looking now at FIGS. **2** and **3**, the clamp **90** is illustrated which is utilized in conjunction with the knives **70** to hold and seal the lidding material film **18** over the tray **14** while the knives **70** soften and sever the lidding material **18** around the periphery of the tray **14** to form the cover. The clamp **90** conforms to the shape defined by the interior of the knife ring **40** and is preferably rectangular in shape with dimensions slightly less than the interior dimensions of the knife ring **40** such that the clamp **90** can be positioned within the knife ring **40** without interfering with operation of the knives **70**. The clamp **90** also preferably includes a member of bores **92** spaced from one another and extending through the clamp **90** between an upper end **94** and lower end **96**. The clamp **90** can be formed of any suitable, rigid material, including aluminum, as such the clamp **90** can also be heated by the strip heater **60** or another heating member during operation of the tray-sealing machine to melt and seal the lidding material **18** to the tray **14** to form the cover. Because the primary function for the clamp **90** causes the clamp **90** to contact the film **18**, and due to the proximity of the clamp **90** to the knife ring **40** during the process of severing and sealing the film **18** to the tray **14**, preferably the clamp **90** also includes the exterior coating **80**. The coating **80** on the clamp **90** can be formed of the same material as is applied to the knife ring **40** and knives **70** or can be a different electroless metal coating, or a coating **80** that is integrally formed with the material constituting the clamp **90**. In either case, the coating **80** is deposited on the clamp **90** in a similar or identical process and functions identically to the coating **80** on the knife ring **40** and knives **70**, thereby preventing the lidding material **18** forming the cover on the tray **14** from securely adhering to the clamp **90** such that the lidding material **18** falls away from the clamp **90** when the clamp **90** is moved away from the tray **14** by the machine, or so that any lidding material **18** that does remain attached to the clamp **90** is easily removed.

[0030] Further, while the above description has covered the preferred embodiments of the present invention, other alternatives are also possible. For example, the coating **80** can be selectively applied to only those portions of the tooling **30** that directly contacts the lidding material film **18**, thereby reducing the amount on each tooling, as well as reducing the associated time and costs for applying the coating **80**. Also, the coating **80** can be applied to tooling **30** that is not heated prior to severing the film **18** to prevent the film **18** from adhering to the tooling **30** under various non-heated conditions.

[0031] Various alternatives and other embodiments are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter regarded as the invention.

I hereby claim:

1. Tooling for use in severing lidding material to a tray, the tooling comprising;

a) a heated sealing member adapted to seal the lidding material to the tray;

b) a heated cutting member adapted to cut the lidding material around the tray; and

c) a release coating deposited at least partially within both the sealing member and the cutting member to prevent the lidding material from adhering to the sealing member and the cutting member.

2. The tooling of claim **1** wherein the release coating is formed at least partially of at least one fluoropolymer.

3. The tooling of claim **2** wherein the at least one fluoropolymer comprises particles having a size of less than 1 micron.

4. The tooling of claim **3** wherein the at least one fluoropolymer consists of particles having a size of less than 1 micron.

5. The tooling of claim **1** wherein the cutting member comprises:

a) a knife ring; and

b) a knife set connected to the knife ring, wherein the release coating is deposited at least partially on the knife ring and the knife set.

6. The tooling of claim **5** wherein the knife set includes a pair of knives, each knife having a lower cutting edge.

7. The tooling of claim **5** further comprising a heating element disposed on the knife ring and capable of heating both the knife ring and knife set.

8. The tooling of claim **1** wherein the sealing member is mounted within the cutting member.

9. The tooling of claim **1** wherein the release coating is deposited at least partially within the sealing member.

10. The tooling of claim **8** wherein the sealing member is generally rectangular in shape.

11. The tooling of claim **9** wherein the cutting member is generally rectangular in shape.

12. The tooling of claim **1** wherein the release coating is formed at least partially of a nickel layer.

14. A cutting member for severing a thermoplastic web around an item, the cutting member comprising:

a) a body having an upper end and a lower end, the lower end including a cutting surface; and

b) a release coating integrally formed within the cutting surface.

15. The cutting member of claim **14** wherein the release coating is formed with submicron particles of at least one fluoropolymer.

16. The cutting member of claim **15** wherein the release coating is formed with a nickel alloy component.

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