ROTARY BAG MACHINE WITH SKIRTLESS SEAL

Inventors: Paul A. SELLE, Appleton, WI (US); Kenneth C. RADTKE, Appleton, WI (US); Charles H. SAUDER, Appleton, WI (US); Paul A. JOHNSON, Menasha, WI (US); Christopher Lee WHITE, Watermeet, MI (US); Arvid R. JOHNSON, Appleton, WI (US); Gregory T. PRELLWITZ, Black Creek, WI (US); Michael J. STICKNEY, Appleton, WI (US); Thomas C. JANSEN, Appleton, WI (US); Christopher A. SAUCIER, Yarmouthport, MA (US); Terry L. LETIZKE, Hortonville, WI (US); Bradley J. SCHMOLL, Appleton, WI (US); Chris SCHRIJLES, Greenleaf, WI (US); Gregory JOHNSON, Greenville, WI (US); Scott GRASSE, Hortonville, WI (US)

Correspondence Address:
GEORGE R CORRIGAN
5 BRIARCLIFF COURT
APPLETON, WI 54915 (US)

Assignee: CMD Corporation, Appleton, WI

Filed: Nov. 9, 2007

Related U.S. Application Data
Continuation-in-part of application No. 11/331,466, filed on Jan. 13, 2006.

Publication Classification
Int. Cl. B32B 37/30 (2006.01)
U.S. Cl. 156/251; 156/367; 156/446; 156/515

ABSTRACT

A machine and method for making bags is described and includes a web traveling from an input section to a rotary drum, to an output section. The rotary drum includes at least one seal bar, having a single sealing zone, and an weakening zone disposed within the single sealing zone. The single sealing zone may be a heated perforator, includes a heating wire. The heating wire may be an NiCr wire and make intermittent contact with the web and be disposed in an insert. The weakening zone may create a line of weakness that is uniform or varies in intensity. The sealing zone may include temperature zones, cartridge heaters, cooling air, or heated air, or a source of ultrasonic, microwave or radiative energy.
ROTARY BAG MACHINE WITH SKIRTLESS SEAL

FIELD OF THE INVENTION

The present invention relates generally to the art of bag making. More specifically, it relates to bag making machines and a bag making method that create bags from a film or web and form seals and perforations or a line of weakness separating adjoining bags made from the web.

BACKGROUND OF THE INVENTION

There are many known bag machines. One style is a rotary drum machine. Rotary drum machines are well known, and a detailed description may be found in U.S. Pat. Nos. 6,117,058, 4,934,993, 5,518,559, 5,587,032 and 4,642,084 (each of which is hereby incorporated by reference).

A detailed description of the operation of rotary bag machines may be found in the patents above, but their general operation may be seen with respect to Fig. 1. A prior art rotary bag machine continuously processes a web using a dancer assembly, a pair of drum-in rolls and a sealing drum. A pair of drum-out rolls and a sealing blanket, a pair of knife-in rolls and a knife which could be any other web processing device such as a perforator, knife, die cutter, punching station, or folding station, a pair of knife-out rolls and an input section, and a controller. Input section, as used herein, includes the portion of a bag machine where the web is received, such as an unwind and a dancer assembly. Output section, as used herein, includes assemblies that act on a web downstream of the seals being formed, such as perforators, winders, folders, etc.

The web is provided through dancer assembly to drum. Drum includes a plurality of seal bars. The seals bars are heated and create the seals forming the bags from web. Web is held against drum (and the seals bars) by a Teflon® coated blanket. The distance between seals created by the drum is related to the bag length (for bags formed to end to end) or the bag width (for bags formed by making side seals). End to end bags are formed with one seal from the drum, and side to side bags are formed with a pair of seals. The drum diameter may be adjusted and/or less than all of the seal bars turned on to determine the distance between seals, and hence bag size.

Generally, rotary motion machines registers a downstream rotary knife to perforate between two seals, or beside a seal. Variations due to tension, film gauge variation, machine variations etc., occasionally causes seals to get cut off.

The prior art of Fig. 1 provides that after web leaves drum it is directed to rotary knife, which creates a perforation between bags, or could separate adjoining bags. When the bags are end to end bags the perforation is placed close to the single seal such that when the bags are separated, the perforation and the perforated end is the top of one bag, and the seal is the bottom of the adjoining bag. Ideally, the perforation is close to the seal to reduce waste, although this is difficult in practice. When bags are formed side to side, the perforation is made between the pair of seals. A seal is needed on both sides of the perforation, since the side of both bags should be sealed. The web between the pair of seals is wasted. Thus, the pair of seals should be close to one another to reduce waste, although this is also difficult in practice.

Controller is connected to the various components to control speed, position, etc. Sensors may be used to sense print on the web to form the seals and/or register the perforation (place it in the correct location with respect) to the seal. Also, sensors may detect seals to try and create the perforation in the correct location. Sensing the seal has proven to be difficult. One prior art example of a system that sensed seals is described in U.S. Pat. No. 6,792,807, hereby incorporated by reference. If the perforation is placed too close to one side seal, then the seal may be cut off, rendering the bag useless.

Because sensing the seal is difficult, much waste is generated in bag making, or bags are ruined. The wasted web, (i.e. the web between a seal and the adjacent perforation), or the web used to make the ruined bag, can be very costly, particularly for high speed bag machines where the number of bags made per hour is great.

Another problem of prior art machines is that perforations may be skewed with respect to the seals, because the perforations are created downstream, and the web can wander or stretch. Also, a mechanical perforation knife must be adjusted every few days to continue to perform properly. Generally, sharp mechanical knives cannot be adjusted to change the perforation strength, and they can be costly, complex, and difficult to use.

Other type of bag machines, such as intermittent motion machines (not rotary drum machines) use burn-off seals to seal and cut or perforate at the same time but speed is limited to about 300 fpm due to the reciprocating motion, dwell time, and difficulty handling the loose bags. Other intermittent motion machines, such as the CMD Icon™, have seal bars with an integral toothed blade. The CMD CM300™ machine has oscillating motion to move seal bars that have an integral toothed blade. Generally, intermittent motion machines are not as fast as rotary drum continuous machines, and thus produce far fewer bags per machine hour.

Accordingly, a method and machine for making bags that enhances the ability to locate the perforations close to the seal is desirable. Preferably this can be done without a downstream knife, to avoid problems associated therewith. Also, this is preferably done on a continuous motion machine, to avoid the slowness and difficulties associate with intermittent machines.

SUMMARY OF THE PRESENT INVENTION

A bag machine, according to a first aspect of the invention, includes an input section, a rotary drum, and an output section, wherein a web travels from the input section, to the rotary drum, to the output section. The rotary drum includes at least one seal bar which has a single sealing zone that forms a single seal, and further includes a weakening zone within the first sealing zone, that forms a weakened zone within the single seal.

The weakening zone is a heated perforator, and/or includes a heating wire, and/or a thin film heater according to various embodiments.
The heating wire has, connected thereto, a source of power that is at an adjustable voltage or magnitude, and/or pulsed, and/or a feedback loop is provided in other embodiments.

The heating wire is a nickel chromium resistance wire, preferably about 80% nickel and about 20% chromium, and/or a thin film heater, and/or a resistance heater, and/or disposed to be make intermittent contact with the web, and/or has a resistance of about 4 ohms/ft, and/or disposed in an insert and/or cartridge on the seal bar in various embodiments.

The insert is comprised of Muscovite® mica, Phlogopite® mica, Glashterm® composite, or similar electro-insulating material and/or has a plurality of holes disposed along a line in the cross direction in other embodiments.

The single seal extends at most 0.125 or 0.25 inches in the machine direction in various embodiments.

The weakening zone is disposed to create a line of weakness that varies in intensity, and/or is a separating zone, and/or includes a heated blade, and/or includes a row of pins, and/or includes a source of air directed at the web, and/or includes a source of vacuum in various embodiments.

The heated blade is retractable in accordance with another embodiment.

The first sealing zone includes a plurality of independently controlled temperature zones capable of making side seals and tape seals and/or includes at least two parallel sealing subzones, extending in the cross machine direction, and the perforating zone is disposed between the at least two parallel sealing subzones in various embodiments.

The single sealing zone include a plurality of independently controlled temperature zones capable of making side seals and tape seals, and/or include cartridge heaters with a plurality of heat zones, and/or include a source of air disposed to cool at least a portion of the single sealing zone, and/or include at least one port for directing heated air to the web, and/or include at least one of a source of ultrasonic energy, microwave energy, and/or of radiative heat in various embodiments.

A sealing blanket is disposed to hold the web against the rotary drum and may be made of polyester material with a silicone layer that contacts the web in other embodiments.

The rotary drum has an adjustable diameter in another embodiment.

According to a second aspect of the invention, a bag is made by receiving a web, forming a single seal on the web using a seal bar on a rotary drum, and forming a weakened area within the single seal. The weakened area is formed during at least a portion of the time the first seal is being formed.

The weakened area is formed for less than the time the first seal is being formed, and formed for about half the time the first seal is being formed in various embodiments.

Forming a weakened area includes, forming a consistently weak line, and/or forming a perforation, and/or forming a line of weakness that varies in intensity, and/or separating adjoining bags, and/or applying a vacuum to the web, and/or directing air at the web in other embodiments.

Forming a perforation includes heating a wire, and/or resistance heater, and/or thin heat film, and/or contacting the web with a toothed blade that may or may not be retracted after the perforation is formed, and/or contacting the web with a row of pins, and/or forming an auxiliary seal adjacent the perforation in various embodiments.

The wire has power applied thereto at an adjustable voltage, and/or that is pulsed in other embodiments.

A signal indicative of heat in the wire is monitored and the power applied is controlled in response thereto in various embodiments.

The single seal extends at most 0.125 or 0.25 inches in the machine direction in various embodiments.

Forming a single seal includes bringing at least two parallel sealing subzones into thermal contact with the web, and forming the weakened area includes bringing a weakening zone disposed between the parallel sealing subzones into thermal contact with the web in another embodiment.

The single seal has a plurality of independently controlled temperature zones, and/or are cooled, and/or are formed using ultrasonic energy, microwave energy, and/or radiative heat in various embodiments.

According to a third aspect of the invention a perforator for a rotary bag machine is an insert for a rotary drum including a single sealing zone and a weakening zone within the single sealing zone. It may or may not be retrofitted to existing machines.

According to other embodiments, the sealing zone is comprised of a heating wire, an electrical insulating layer/release layer, a glashterm® or mica layer, and an aluminum block, in that order, where the wire and electrical insulating layer/release layer come into contact with the film.

According to other embodiments, the sealing zone is comprised of a double sided tape, a heater, a heat conductive layer, a wire and a release layer, in that order, where the release layer comes into contact with the film.

Other principal features and advantages of the invention will become apparent to those skilled in the art upon review of the following drawings, the detailed description and the appended claims.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is bag machine in accordance with the prior art;

Fig. 2 is rotary drum in accordance with the present invention;

Fig. 3 is an end view of a seal bar in accordance with the present invention;

Fig. 4 is a side view of a seal bar in accordance with the present invention;

Fig. 5 is an end view of a seal bar in accordance with the present invention;
FIG. 6 is an end view of a seal bar in accordance with the present invention;

FIG. 7 is a side view of a seal bar in accordance with the present invention;

FIG. 8 is an end view of a seal bar in accordance with the present invention;

FIG. 9 is a side view of a seal bar in accordance with the present invention;

FIG. 10 is an end view of a seal bar in accordance with the present invention;

FIG. 11 is a side view of a seal bar in accordance with the present invention;

FIG. 12 is an end view of a seal bar in accordance with the present invention;

FIG. 13 is an end view of a seal bar in accordance with the present invention;

FIG. 14 is a side view of a seal bar in accordance with the present invention;

FIG. 15 is a segment of a cross-sectional view of a seal bar insert in accordance with the present invention;

FIG. 16 is a segment of a cross-sectional view of a seal bar insert in accordance with the present invention;

FIG. 17 is a part of an insert in accordance with the present invention;

FIG. 18 is a part of an insert in accordance with the present invention;

FIG. 19 is a part of an insert in accordance with the present invention;

FIG. 20 is a part of an insert in accordance with the present invention;

FIG. 21 is a part of an insert in accordance with the present invention;

FIG. 22 is a part of an insert in accordance with the present invention;

FIG. 23 is a part of an insert in accordance with the present invention;

FIG. 24 is a perspective view of a seal bar in accordance with the present invention;

FIG. 25 is a side view of a seal bar in accordance with the present invention;

FIG. 26 is a top view of a seal bar in accordance with the present invention;

FIG. 27 is a side view of the insert of FIG. 26;

FIG. 28 is a seal and weakened zone in accordance with the present invention;

FIG. 29 is an end view of a seal bar in accordance with the present invention;

FIG. 30 is an end view of a seal bar in accordance with the present invention;

FIG. 31 is an end view of a seal bar in accordance with the present invention;

FIG. 32 is an end view of a seal bar in accordance with the present invention;

FIG. 33 is an end view of a sealer/perforator in accordance with the present invention;

FIG. 34 is a seal and weakened zone in accordance with the present invention; and

FIG. 35 is a perspective view of a segment of a seal bar insert in accordance with the present invention.

Before explaining at least one embodiment of the invention in detail it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments or of being practiced in any various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting. Like reference numerals are used to indicate like components.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention will be illustrated with reference to a particular bag machine, it should be understood at the outset that the invention can also be implemented with other machines, and using other components. Bag machine, as used herein, includes a machine used to make bags such as draw tape bags, non-draw tape bags, and other bags. Any input section (unwinds and dancrs, e.g.) and any output section (winders, foldere, e.g.) may be used with the present invention. Bags may be comprised of traditional poly material, other materials such as starch, polycylic acid (PLA), cellulose, polyhydroxy alkanoates (PHA), and lignin, and/or be biodegradable, compostable, etc., such as Mater-Bi®, Ecoflex®, Ecovio®, Bioplast GF106®.

Generally, the present invention provides for a rotary bag machine with an input section, a drum section, and an output section. A perforation or line of weakness is formed on the rotary drum, for at least part of the time the seal is being formed. For example, on a rotary bag machine the web might be in contact with the drum for about one-quarter of the drum cycle, and the perforator formed in one quarter of the drum cycle. The seal bar includes a sealing zone and applies heat as the drum rotates, thus forming the seal. Seal bars, as used herein, includes an assembly, such as on a rotary drum, that applies heat to and seals the web, and the mounting mechanisms, perforators, etc. Sealing zone, as used herein, includes the portion of a seal bar that creates the seal.

The seal bars can have independently controlled temperature zones, for example for applying more heat to a hem or draw tape portion of a side seal. Independently controlled temperature zones, as used herein, includes temperature zones along a sealing zone that can be controlled or caused to be different temperatures.

A perforator or weakening zone can be mounted on the seal bar, for example as part of an insert. The weakening zone can create a perforation or weakened area as the seal is being formed. The perforation can be created with heat,
radiation, or by mechanical contact. Weakening zone, as used herein, includes the portion of a seal bar that creates a weakened area. Weakened area, as used herein, includes an area on the web which is weakened, such as by a perforation or a portion of the web being melted or burned off.

Another embodiment provides for creating a single seal, such as an auxiliary sealed area, with the perforation created as part of the single sealed area. The single sealed area can be created using two seals that melt to form a single seal, or a weakening zone that provides sufficient heat to seal the web or film surrounding the weakened zone. In either case, the single seal is comprised of two parallel sealing subzones, with a perforation or weakened area within the single seal. Other sealing techniques may be used. The single seal embodiment can be combined with other embodiments described above or below, such as hem or draw tape seals, varying intensity seals and perforations, etc.

Sealing subzones, as used herein portions of a seal formed by heat from different sources. Within the sealing zone, as used herein, includes within the boundaries of a single sealing zone. Within a single seal, as used herein, includes within the boundaries of a single seal. Single seal, as used herein, includes an area of film that is melted to form a seal without unsealed portions that extend a substantial distance in the cross machine direction. A single seal may have small gaps in the seal, either intentionally or inadvertently.

The heated perforator may include a wire in intermittent contact with the web, to create the perforation pattern. Intermittent contact between the web and a sealing or perforating element, as used herein, includes the web being in contact with the element at some locations and not in contact at other locations, such as contact and no contact alternations along a cross-machine direction line.

One embodiment provides for retrofitting existing machines by placing an insert on existing seal bars, or by replacing seal bars with seal bars designed to have a weakening zone, such as with an insert.

The blanket may be blankets such as those found in the prior art, although the preferred embodiment includes a blanket that is a belt consisting of 2-ply polyester material with 1/32" ground silicone top cover Silam K® (55 durometer) with an endless length. Other blankets, preferably able to handle the high intermittent temperatures (600-800 °F) that can be reached while burning a perforation and that have good release characteristics so the film does not stick to the beltimg, are contemplated in various embodiments, and may be Teflon®, silicon, hyb+ids, etc. Another embodiment uses a fine fabric mesh impression in the silicon surface of the blanket. This results in an impression made in the film that can aid in sealing or perforating and also improve the release characteristics.

Turning now to FIG. 2, a drum 200 consistent with the present invention is shown. Drum 200 includes four seal bars 229, and a blanket 230 that holds a web or film against drum 200 and seal bars 229. Drum 200 operates generally as the prior art drum, but seal bars 229 include a perforator.

Drum 200 is preferably one similar to the CMD 1270GDS Global Drawtape System® and has approximately 0.5 seconds of seal dwell time at 600 fpm and has an adjustable diameter to easily change product repeat lengths. It has 4 seal bars equally spaced around the circumference that span across a 50" web width. This drum can be used for making trash can liners or garbage bags, for example. Other drums could consist of more or less seal bars, larger or smaller diameter, or narrower or wider web widths.
Referring now to FIG. 3, an end view of a seal bar 229 is shown. Seal bar 229 extends the width of the drum, and includes two sealing zones 302 and 304, a cartridge heater 310, and a thermocouple 308. An insert 306 that includes a perforator is mounted on seal bar 300.

Seal bar 300 preferably has a uniform temperature range across a given width of a web, with an independently controlled temperature zone at the edge for making a side seal while simultaneously making a tape seal with bar 401. Cartridge heater 310 is a custom wound heat zone such as those available from Watlow® or Thermal Corp. in the preferred embodiment. The temperature profile for specific or different temperature setting combinations (desirable especially on thin films) may be controlled using compressed air cooling of hot zones, as described below. Air cooling is also used for isolating different temperature zones which are located next to each other but are set at greatly different temperatures such as 300 F (bar 304) for side seals but 450 F (bar 401) for tape seals, in various embodiments.

Referring now to FIG. 4, a side view of seal bar 229 is shown. Seal bar 229 includes, in the preferred embodiment, a first temperature zone 401 for a draw tape seal (or for a hem) and a second temperature 402 for making a side seal. Temperature zone 402 may include multiple temperature zones 403, 404 and 405.

One alternative embodiment provides for seal bars that form side seals only, with no drawtape seal zone. Another embodiment, provides for a seal bar that makes a bottom seal with only one seal (the perforation preferably does not have an auxiliary seal in this embodiment). FIG. 5 is an end view of a seal bar 500 that has a single sealing zone 501 that makes a total burn-off cut to separate adjoining bags. A weakening zone may be mounted to seal bar 500 to form a weakened area. The weakening zone may be made as described herein with respect to side seal arrangements.

FIG. 6 (end view) and FIG. 7 (side view) show a seal bar 600 that has a single sealing zone 601 that makes a total burn-off cut with perforation notches 701 cut in the tip. The seal bars and heaters therein may be comprised of different material in various embodiments, such as a tubular heater cast in aluminum (available from Watlow®).

Cartridge heater 310 is replaced with a flexible silicone rubber heater 901 and 903, as shown in FIGS. 8 and 9, in another embodiment. Heaters 901 and 903 are held on the sides of an aluminum bar using pressure sensitive adhesive (available from Watlow®).

An alternative seal bar 1000 is shown in FIG. 10 (end view) and 11 (side view). Seal bar 1000 includes nickel chromium resistance or heating wires (Ni—Cr wires) 1001 and 1002, connected to a DC or AC power supply 1005. The wires can be separate wires with separate power supplies, parallel wires, or series segments of a wire. Power to the wire may be on constantly, pulsed on and off, or have an otherwise varying power level. Proper timing of the pulses allows the seals to cool prior to where the web leaves the drum, for easier separation of the web from the seal bar.

Another embodiment is seal bar 1200, shown in FIG. 12 (end view). Seal bar 1200 seals using focused infrared light (the dashed lines indicate representative light paths), and includes light sources 1202 and 1204, reflectors 1206 and 1208, and glass strips 1210 and 1212. The surface of glass strips 1210 and 1212 are preferably coated with Teflon® or a similar release agent.

Laser or focused light directed with a moving or pivoting mirror or lens is used on other embodiments. The laser can be positioned in the center of drum 200, and a pivoting mirror (or a linear actuator) can be used to direct the laser light through a glass seal bar at the periphery of the drum (again, the glass can be coated for easier release). The seal bar can have a continuous line of glass for forming seals, and alternating intermittent regions of opaque and clear for creating perforations.

Another alternative seal bar 1300 is shown in FIG. 13 (end view) and FIG. 14 (side view). Seal bar 1300 uses compressed air provided through pipes 1301 and 1302. A plurality of ports 1305 terminate in a pair of grooves 1307 and 1308 in the surface of sealing zones 302 and 304. Other alternatives use ultrasonic, microwave, or radiation heating of the web.

Insert 306 has, in the preferred embodiment, a Ni—Cr wire woven into a shape that produces intermittent contact with the web (such as areas of contact where film is burned away, and areas of no contact where film is not burned away to create perforations). The Ni—Cr wire is pulsed on for the first half of the dwell time (the time the web is against the seal bar) and allowed to cool the second half of the dwell time so the perforations are non-molten when the web separates from the perforator. This allows a stronger web, reduces film sticking to the wire, and eliminates the chance of the perforation melting shut.

Referring now to FIG. 15, a side view of a segment of insert 306 is shown, and, in one preferred embodiment, is a 0.12 inch thick machinable glass-mica ceramic (available from McMaster-Carr) with a row of holes 1501, that are alternately spaced 0.25" and 0.12" apart, along the 50 inch length of insert 306. The holes have a diameter of 0.06 inches. A resistance or heating wire 1502 comprised of about 80% nickel and 20% chromium, 0.013" diameter, 4 ohms/ft, annealed soft (available from Pelcom Wire Co.), is woven through the pattern of holes such that the greater length is on the web facing surfacing top, and the shorter length (between holes) is on the opposite surface. Wire 1502 is flattened to lay against the mica, and the holes are rounded to reduce wire stress. High temperature (650 degree F) flexible silicone caulk is applied to fill holes and air gaps around the wire (available from NAPA 765-1203 PTEX HI-T). This reduces wire hot spots and allows wire 1502 to expand and contract each cycle. The preferred embodiment uses a woven design to reduce the need for large wire tensioners that would be used in alternative designs because a 50" long wire would expand 0.38" every cycle. A glass mica layer 0.03 inches thick (not shown) is applied to the bottom (the side not facing the web) of insert 306 to insulate the wire from the aluminum housing. Preferably insert 306 is sized on constantly, pmsg seal bar designs. An adjustable DC or AC power source provides a pulse of power for the first half of the dwell time in the preferred embodiment.

One alternative designs is shown in FIG. 16, where insert 306 has wire 1502 pushed into a series of cavities in the mica glass insert 306. The cavities extend the 50 inch length of insert 306, and are disposed every 0.25 inches, with a 0.06 inch diameter hole. The cavities are filled with flexible silicone caulk 1601.
Another embodiment of the invention includes an insert 2600, shown in FIG. 26, and includes a separate heat zone 2601, such as for heating a hem or draw tape region. Various embodiments provide for region 2601 to be used with or without a perforation that extends across the film (the perforation could cross a drawtape, and the seal could extend the width of the film, e.g.). Within region 2601, a 0.020 in. mica layer (or a Glasstherm HT® layer) 2603 is provided. A NiCr wire is disposed in a series of cavities or holes (as in FIG. 16). The holes are located every 0.312 inches, and have a 0.050 in. diameter in region 2601. The insert is 0.25 inches wide, and the seals (between which the perforation is made) are 0.25 inches apart.

The side view of insert 2600, shown in FIG. 27, shows a NiCr wire 2701 disposed in the holes in region 2601. The wire preferably has a 0.0089 in. diameter in region 2601. Wire 2701 is serially connected to a 0.0126 NiCr wire 2703 (using a crimp 2705). The larger wire requires larger holes (0.062 in. in the preferred embodiment). The wire sizes can be chosen to select the wire resistance, and thus the heat provided. Wire 2703 is soldered to and/or wrapped around a preferably silver pin to be connected to a high temperature wire 2707 with a crimp connection. A release layer may be placed over the wire or between the wire and insert base. Release material may include: Teflon®, Rulon®, Kapton®, Mica® tape, Resbond® painting, and Rescor® paint.

The NiCr wire may be turned on and off (current flow) to control temperature of the wire/sealing. For example, the wire may be turned on immediately after contacting the film (or blanket), and turned off immediately after the contact with the film (or blanket) ends. Alternatives include connections other than serial between wires 2701 and 2703, more heat zones (and wire connections/types), controlling heat with external resistors/potentiometers or current magnitude, such as with PWM. If a pot is used the user could adjust the relative temperature by adjusting the pot. Other embodiments include combining these features, or other on/off schemes. This and other embodiments may be used with any other bag where a perforation needs to be placed next to a seal, such as t-shirt bags, including reinforced t-shirt bags, draw tape bags, side seal bags, etc. The wire may be off for part of the time the seal is being made and on for at least a portion of the time the first seal is being formed. One embodiment calls for preheating the wire when it is not in contact with the film so it is turned off while in contact with the film, relying on the wires retained heat to burn the perforations.

The blanket preferably has a 0.03-0.012 in. thick silicone rubber top surface with a matte finish, durometer 50-90 Shore A, initially seasoned with a talc powder. The wire may be held in the holes using a Resbond® high temperature adhesive, injected into the holes using a syringe. Hard or flexible adhesives, or both, alternating, e.g. may be used. Flexible adhesives allow the wire to flex, which can occur when it is heated and cooled. The insert may be held in place with five cone point set screws 2605 or with flat tip set screws.

Another alternative is shown in FIG. 17, where wire 1502 is spirally wound about a 0.06” ceramic rod 1701 and bonded with flexible silicone caulk, everywhere except where wire 1502 touches the web.

Other alternatives are shown in FIGS. 18-22 and include a straight wire 1502 across the width of the web but making cold spots on wire 1502 with copper coated portions 1801. FIG. 19 shows a design where cold and hot spots are created with areas 1901 of backing materials of different heat conduction rate. FIG. 20 shows a design where cold or hot spots are created with notched recesses 2001. FIG. 21 shows a design where cold spots are created with air cooling of intermittent spots through ports 2101. FIG. 22 shows a design where cold spots are created with thin strips 2201 over wire 1502.

Other alternatives provide for wire 1502 to be round, a rectangular ribbon, straight or woven at a uniform or varying pitch, uniform thickness or non-uniform thickness along their length (to create hot/cold spots), Toss® wire, tapered, or profiled to make two side seals between a burn off cut. Profiled wire may have intermittent copper plating to perforate rather than clean cut. Varying pitch for a woven wire or different hole spacing creates a weakened area of varying weakness, that allows the bag to be torn by hand easier at the edge than in the middle of the web. Other designs contemplated include flexible silicone rubber heaters, thick film heating technology, sintered ceramic, or the like available from Watlow Electric Manufacturing Co. Yet other alternatives include using thin film heating technology mounted on a PNEUSEAL™ rubber inflatable diaphragm that can stay hot all the time but physically move in and out of contact with the film by inflating and deflating the diaphragm.

Other alternatives includes a wire that is constantly hot but is physically moved in and out of contact with the web during the seal dwell phase. Hot wire segments (stitches) could be connected to a power source in parallel or in series. Parallel is preferred to reduce the amount of current required. Hot wires are preferably potted into a replaceable insert that can be easily replaced in the field and mass produced. Hot wires could be coated with substance to improve release characteristics.

Alternative perforators include a toothed blade 2301 (see FIG. 23) that penetrates the sealing blanket. In one embodiment the sealing blanket is kept in phase with the perforator to avoid damage to the blanket in the area where seals occur. The toothed blade may be extended all the time or extend and retract each cycle (driven by spring, pneumatics, or cam). One alternative is to use a row of pins rather than a row of teeth. A vacuum provided through the seal bar is preferably used to hold the film onto a row of pins so the pins do not need to penetrate the blanket. Each pin may be disposed in a recessed groove or hole if the vacuum sufficiently holds the film to the. The knife backing material may be the blanket, a silicone blanket, Teflon® blanket, silicone roller, brush roller, short section of silicone belt, or a series of soft rollers. The knife may perforate prior to the seal dwell area.

Another alternative is to use hot compressed air jets 2402 (FIG. 24) that receive air from a pipe 2401, and are disposed in an array to melt and blow a row of hole perforations. The air source is cold in one embodiment, and the air is heated by focused infrared light, radiation, convection, or conduction. Other alternatives includes sticking the film onto or over a sharp object, projecting a small solid particle or liquid particle at the web to create a hole or
pattern of holes, a linear notched rotary “pizza cutter” blade moving across web cutting against a sealing belt or metal belt/brand, a straight edge knife mounted in or next to the seal bar provided with a fixed anvil outside the drum used as a shear cut or a flex blade type knife assembly.

[0113] The preferred embodiment controls the heat of a burn-perf wire by controlling the voltage of a DC circuit. Preferably the lowest voltage that provides an acceptable perforation is used. For example, a 0.013” diameter 80/20 Ni—Cr wire woven alternating between 0.25 inch in contact with the web and 0.12 inches below the mica requires approximately 20 watts per inch of web width to burn perforations in 0.75 mil LLDPE film two layers thick at 600 feet per minute. Thus, a 2 inch long perforator would use 10 volts pulsed on for about 0.25 seconds as soon as the film is sandwiched between the perforator and the seal blanket. With a 0.5 second dwell time, the perforation has about 0.25 seconds to cool. The preferred embodiment thus allows the perforation to be quickly heated and cool down. The adjustable voltage is supplied by a DC motor controller in one embodiment. Other embodiments includes a mechanical rheostat, potentiometer, or adjustable resistor. An adjustable AC voltage can preferably be used.

[0114] A controller may be used to compensate for resistance changes over the life of the wire. For example, a Toss® controller has current sensing feedback and adjusts voltage accordingly to maintain a more consistent temperature. Cartridge heaters may be controlled with thermocouple feedback using PID temperature control, as is well known in the industry.

[0115] The preferred embodiment provides for consistent incoming tension and consistent incoming accumulation to consistently form seals and perforations. The preferred embodiment includes a servo infeed nip with ultrasonic accumulation loop feedback. Alternatives includes a mechanical lay-on roll assembly. Static induction pinning is used to help the film lay flat against the sealing blanket.

[0116] A tension zone isolator nip, also called a chill roll nip, is used as the web exits the sealing drum area. The preferred embodiment uses a 2” wide double groove diamond shape is cut into the face of the roll to allow minor air bubbles or wrinkles to flush out rather than build up ahead of the nip.

[0117] After leaving the drum the web is provided to folding boards. Hard-board filler plates with 1/4” diameter holes 3” from the tip of standard V-board with symmetrical geometry near the tip of the V-board are provided to reduce tension surges due to wrinkles or air entrainment. Also, transporting the folded web over two idlers before going through a rubber nip and an additional 1/4” thick air relief blade is inserted between film layers just prior to the rubber nip to allow air to bleed out rather than getting trapped inside wrinkles.

[0118] Air cooling of hot zones, briefly referred to above, generally includes ports or channels in seal bar, for example created by drilling or machining, to allow compressed air to flow through a desired zone or zones. FIG. 25 shows seal bar 229 with a plurality of ports 2501 and a plurality of valves 2502. Thus, the amount of compressed air that flows through each zone is controlled by valves 2502. Air cooling could also be used for isolating different temperature zones which are located right next to each other but are set at greatly different temperatures such as 300 F for side seals but 450 F for tape seals. As with many feature disclosed herein, the air cooling can be practiced without practicing other features of the invention, such as without insert 306.

[0119] Another embodiment provides for using a single seal bar, with a perforation within the seal. Referring now to FIG. 28, a seal zone 2800 is delineated by dashed lines 2803 and 2805 (the lines do not appear on the actual product, but indicate where the sealed zone ends). The seal bar can include a wire, such as in the embodiments described above, that creates holes 2807, extending across the film, and creating a weakened zone. The holes may be linear, or randomly placed. In either case, a seal that includes a perforation is formed. Adjacent bags may be separated along the seal by tearing. The perforation may be a line, or through the sealed zone. Other embodiments include simply creating a perforation (without the seal, or with partial seals), on the drum. A vented leaf bag may only require seals 3401 around each perforation 3403, without a continuous seal, as shown in FIG. 34.

[0120] The single seal/perforation may be created using a contoured seal bar, a previous embodiment with the temperature controlled to burn through in places, fine fabric impression (bumpy or textured) blanket, such as a Habasit® WVT-136 silicone rubber blanket, where the pressure of the “bumps” burns through the plastic.

[0121] The single seal may also be created using two seal bars such as those described above, but disposed close to one another, or made wider, such that the two seals blend together to form a single seal (i.e., no unsealed web between them) comprised of two sub-seals. The sub-seals are generally parallel and extend across the web or film in the cross machine direction, and a weakened area is formed between the generally parallel sub-seals. The perforation may be made using any of the alternatives described above. Another embodiment provides for using one of the embodiments above, but is used by tuning the side seal temperature very low so that the seals are not formed. The perforator then forms the perforation and the seals are the auxiliary seals from the perforation.

[0122] Referring to FIG. 29, one embodiment of a seal bar 2900 that includes a single sealing zone and a weakening zone disposed within the single sealing zone is shown. The single seal, with the perforation formed therein, preferably extends at most 0.25 inches in the machine direction, or more preferably at most 0.125 inches in the machine direction on film 2912 after the seal and perforation have been formed. Extending in the machine direction, as used herein, includes the average distance over a portion of a seal along lines running parallel to the film edge.

[0123] Seal bar 2900 forms a single seal on a web or film 2912. A cartridge heater 2001 disposed within an aluminum block 2003 provides steady heat to seal bar 2900. Wire or resistance heater 2911 provides additional heat that creates the seal and weakened area. Wire 2911 is preferably a NiCr wire 0.009–0.013 inches in diameter. The different sources of heat combine so that both add heat to the seal zone and the weakening zone, although in this embodiment wire 2911 primarily provides heat for the weakening area, and heater 2901 primarily can be thought of preheating the assembly.

[0124] Alternatives provide for a flat or other shaped resistance wire. The flat wire can have a raised ridge or be
curved to form the weakening zone, with cutouts where the solid portions between perforation holes are located. Air under the bend can act as an insulator to affect the heat profile of the ribbon.

[0125] A shim 2905 can be used, particularly for retrofits, to force wire 2911 into tighter contact with web 2912. Other embodiments call for greater shrinking in the hem or draw tape area (of about 0.020 inches in one embodiment), so the web in that area is under greater pressure than the remaining portion of the film, thus providing greater heat transfer for this region, or no shim at all. Another embodiment provides for a backing wheel behind the blanket in a hem or draw tape region that forces the blanket against the web and provides greater pressure in that region.

[0126] An insert 2907 is preferably comprised of, or coated with, an electrical or thermal insulating material to insulate wire 2911. In various embodiments insert 2907, or the electrical insulating material, is comprised of mica, glastherm, fiberglass phenolic, plastics, polymers, aluminum (with an electrically insulating coating) or other materials. Glastherm™, as used herein, includes a composite material of glass fibers and heat resistant thermosetting resins

[0127] A releasing layer 2909 is disposed over insert 2907, and is preferably comprised of Teflon®, Rulon®, or Kapton® tape. The releasing layer or releaser is chosen to be of a material that releases melted film, but able to withstand the temperatures needed to seal and perforate the film. Releasing layer on a seal bar or insert, as used herein, includes a layer that, compared to other materials of the seal bar or insert, reduces the build-up of melted film on the seal bar or insert. This embodiment provides that the film touches only the wire and tape (over the insert), although other embodiments provide that the film touches the insert directly, and/or touches the aluminum block heater. Alternatives provide for coating the wire with a releaser instead of or in combination with the releasing layer. The release may be an application of a liquid layer that later dries such as Resbond®, Rescor®, Teflon® paint, silicone paint, or the like.

[0128] The single seal can extend across the entire film width, or across part of the film with two seals used in one region, such as a hem or draw tape region. The two seals may be formed as described above. Another embodiment provides for two sub seals to be used only in the draw tape area, and a single seal without sub seals formed elsewhere or vice versa.

[0129] The selection of various materials, such as the releaser, insulator, heater, wire, etc., is should be made in consideration of the film thickness, the temperatures desired for perforating (up to 600 °F or more in one embodiment) and sealing the major portion of the film and any hem or draw tape region, and the ability of the sealing surface to release melted film. Improper selection could result in premature wear of the material, or premature buildup of melted film on the sealing surface. Alternatives provide for turning on the wire earlier to preheat it, so it can be turned off sooner, removing the built up film during the time the film is not in contact with the seal bar by, for example, mechanical action, heating, brush, or air blast, etc.

[0130] Other design concerns include the range of types and thicknesses of films that will be used with the machine, heat migrating between the hem and other regions, the perforation and the seal, blanket material, dwell time, removing or addressing wrinkles in the film, ink from the web building up on the sealing surface, and providing different pressure zones.

[0131] Referring to FIG. 31, another embodiment of a seal bar 3000 that includes a single sealing zone and a weakening zone disposed within the single sealing zone is shown. The general description of the seals formed, and design considerations above, apply to this and other embodiments. A wire or resistance heater 3003 mounted on an aluminum heater 3001 creates the seal and weakened area. Mounted on, as used herein, includes directly in contact with, or with other layers or items disposed there between. Heater 3001 may be a support bar rather than a heater. Wire 3003 may be as described above, and a releaser may be provided under wire 3003, over wire 3003, or wire 3003 may be coated, if needed. Wire 3003 is preferably a NiCr wire stitched into an aluminum bar with an electrically insulative coating and/or the wire is coated with an electrical insulator. Preferably, the wire is coated with a releaser (which may also be the insulator).

[0132] Referring to FIG. 31, another embodiment of a seal bar 3100 is similar to seal bar 3000, but heat is provided by a thin film heater 3103 in addition to a wire 3103 and a support bar or heater 3101, to create the seal and weakened area on a web 2912.

[0133] Referring to FIG. 32, another embodiment of a seal bar 3200 is similar to seal bar 3100, but an insulator 3202 is provided between a thin film heater 3203 in addition to a wire 3207 and a support bar or heater 3201, to create the seal and weakened area on web 2912.

[0134] Referring to FIG. 33, a schematic of a single sealer/perforator 3300 comprises a strip that may be affixed to a seal bar or a seal bar insert. Sealer 3300 is easily replaceable, and thus useful for applications where film builds up on the sealer. Sealer 3300 includes a NiCr wire 3301 (which may be similar to wires described above), a releaser 3303 that is also preferably an electrical insulator and may be similar to the releasers described above, a thermal or heat conducting layer 3305, preferably comprised of aluminum to spread the heat created by a resistance trace heater 3307, all of which is mounted to two sided tape 3309. Thus, tape 3309 can be affixed to the top of an insert for use on a support bar or seal bar, or taped directly to the seal bar.

[0135] One modification of this embodiment provides for the releaser to be a tape placed over the wire, and there may or may not be holes or slits on the releaser aligned with the locations where the perforations holes are to be made, so that the wire contacts the film in these locations.

[0136] Referring to FIG. 35, a perspective view of a seal bar insert 3500 is shown, and includes heated aluminum block 3501, with the a heater cartridge 3502. A plurality of pins 3503 extend through the seal bar and create a micro perforation. Pins 3503 are disposed in holes in block 3501 that are disposed at an angle to avoid cartridge 3502. Pins 3503 may be conductive and connected to a wire 3504 to heat pins 3503 to aid in perforating and/or sealing. This embodiment, and the other alternative embodiment may be combined as desired. For example, pins 3503 may be used with a vacuum through the holes holding pins 3503, and/or they may be combined with one of the many ways of
creating the seal and perforations described above on a single seal bar, where the micro perforations aide in creating the weakened zone, or pins 3503 may be the sole manner of forming the perforation.

[0137] The row of pins or needles are in an unheated or heated seal bar and press against a Kevlar® sealing blanket material, which will be less likely to be damaged from the sharp pins penetrating into it, in another alternative. The rows of pins or needles could be placed in blanket, and be held in phase with seal bars on the drum, to create the perforation. Similarly, thin film heaters and/or pins on a belt or blanket can press against a simple drum face. No drum would be required if pressure is applied by the belts against one another, such as by an elliptical shaped belt path for both belts.

[0138] Another embodiment provides for the seal and perforation to be formed using magnetic fields or inductive heat. A magnet (permanent or electric) on the seal bar, with metal in the backing blanket causes extra pressure in the perforation area to melt holes where desired and less pressure in the sealing area. The magnetic fields can be created to be disposed in a line across the film.

[0139] Another embodiment provides for the seal and perforation to be formed together on a non-circular loop, such as an oval or oblong, or on a shuttle machine. Generally, the invention of these embodiments call for the creation of a seal when and where a perforation is created.

[0140] Other methods of perforating and sealing at the same time in a rotary drum to preferably create a perforation down the middle of one narrow seal are included within this invention. For example, three staggered rows of Ni—Cr wire stitches may be used where the outer two rows create the seals and the inner row creates the perforation. Inner refers to the inner in the machine direction.

[0141] One seal may be made with one rounded seal tip when the film is under tension such that the center of the seal thins/weakens/perforates during the sealing process. The seal bar may have a bumpy surface at the crest to create the perforations.

[0142] A seal bar may comprise a resistive coating placed over a shaped electrically non-conductive material so the heat is generated at exactly the sealing surface where it is needed and a complex shape with various sealing heights can be achieved. This could be done adapting thin film heater technology.

[0143] Another embodiment calls for increase sealing blanket pressure, such as by factor of 5, 10 or 20, preferably 10, so that the burn-perforation temperatures can be lowered from 550°F-600°F to a lower temperature where a wider variety of coatings and materials are available (many materials have a 500°F maximum operating temperature).

[0144] Yet another embodiment provides for a sealing bar comprising two parallel heated strips that separate 0.03” to 0.06” during sealing to stretch the film into a line of weakness or perforations between the two strips.

[0145] Film could be tucked into a ⅛” deep recess in the drum seal bar such that perforations can be cut or burned below the surface of the drum without damaging the sealing blanket. The tucking can be mechanical or vacuum assisted.

[0146] Other methods of creating the seal and perforation could be used, such as using radiant heat, microwaves, or light waves tuned to especially heat and perforate the web. Hot glue could be applied, or a liquid from inside drum such that it heat seals the two poly webs together. The perforations could be done simultaneously if hot liquid burns perforation holes at the same time. A hot solid such as sand or poly pellet, or a hot liquid, such as oil, could be forced through web such that it perforates the web while forming a seal at the same time. Or the web could be chemically treated to react with an additive such that film melts together and melts perforation holes where excess chemical is applied. Another alternative includes applying a time activated acid in the drum which allows the web (nonsealed and non-perforated) to be wound and placed inside a carton; then the time activated acid creates a burn-off seal so the web later becomes multiple sealed/separated bags.

[0147] The web could be sealed with conductive heat sealing, and before the dwell time is over the web could be cryogenically frozen in a perforation pattern such that the film fractures at each perforation spot when it is flexed downstream.

[0148] Numerous modifications may be made to the present invention which still fall within the intended scope hereof. Thus, it should be apparent that there has been provided in accordance with the present invention a method and apparatus for making bags that fully satisfies the objectives and advantages set forth above. Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

1. A bag machine, comprising:
an input section;
a rotary drum, disposed to receive a web from the input section, wherein the rotary drum includes at least one seal bar; and
an output section, disposed to receive the web from the rotary drum;
wherein the at least one seal bar includes a first sealing zone that forms a single seal, and further includes a weakening zone within the first sealing zone, that forms a weakened zone within the single seal.

2. The bag machine of claim 1, wherein the weakening zone is a heated perforator.

3. The bag machine of claim 2, wherein the heated perforator includes at least one of a heating wire, a flat thin film heater and a shaped thin film heater.

4. The bag machine of claim 3, further comprising a source of power at an adjustable voltage connected to the heating wire.

5. The bag machine of claim 4, further comprising a feedback loop connected to the heating wire and the source of power.

6. The bag machine of claim 3, further comprising a source of pulsed power connected to the heating wire.

7. The bag machine of claim 3, wherein the heating wire is disposed to be able to make intermittent contact with the web.
8. The bag machine of claim 3, wherein the heating wire is at least one of a nickel chromium resistance wire and a thin film heater.
9. The bag machine of claim 3, wherein the sealing zone is comprised of a insert having a resistance heater.
10. The bag machine of claim 9, wherein the sealing zone includes a first face disposed to contact the web and is further comprised of a double sided tape having a first side disposed to be affixed to a supporting structure, a resistance heater affixed to a second side of the double sided tape, a heat conductive layer, affixed to the resistance heater, an releasing and electrical insulating layer affixed to the heat conductive layer, and a wire heater affixed to the releasing and electrical insulating layer, wherein the wire heater is disposed to be in thermal contact with the web.
11. The bag machine of claim 1, wherein the first sealing zone and the weakening zone include a wire, a releasing layer, and a heat insulating layer, wherein the releasing layer is between the wire and the heat insulating layer, and the wire is disposed to comes into contact with the web.
12. The bag machine of claim 1, wherein the weakening zone is disposed to create a line of weakness that varies in intensity.
13. The bag machine of claim 1, wherein the weakening zone is a separating zone.
14. The bag machine of claim 1, wherein the weakening zone includes a toothed blade.
15. The bag machine of claim 3, further comprising an adjustable source of power connected to the heating wire.
16. The bag machine of claim 1, wherein the single seal extends at most 0.25 inches in the machine direction.
17. The bag machine of claim 1, wherein the single seal extends at most 0.125 inches in the machine direction.
18. The bag machine of claim 1 wherein the first sealing zone extends a first portion of a distance across the web, and a second sealing zones extends across a second portion of the distance across the web, wherein the second sealing zone forms two parallel seals and a weakened area disposed between the two parallel seals.
19. The bag machine of claim 1 wherein the first sealing zone includes at least two parallel sealing subzones, extending in the cross machine direction, and the perforating zone is disposed between the at least two parallel sealing subzones.
20. The bag machine of claim 1, wherein the sealing zone includes a support bar, an insert mounted on the support bar, a releaser mounted on the insert, and a wire mounted over the releaser disposed to contact the web.
21. The bag machine of claim 20, wherein the support bar is an aluminum block heater.
22. The bag machine of claim 21, wherein the releasing layer is comprised of at least one of teflon, kapton, and nylon.
23. The bag machine of claim 22, wherein the insert is has a plurality of holes disposed along a line in the cross direction.
24. The bag machine of claim 23, wherein the heating wire is comprised of about 80% nickel and about 20% chromium, and has a resistance of about 4 ohms/ft, and is mounted in and between the plurality of holes.
25. The bag machine of claim 1, wherein the sealing zone includes a wire mounted on a support bar and disposed to contact the web.
26. The bag machine of claim 1, wherein the sealing zone includes a support bar, a thin film heater mounted on the support bar, and a wire heater mounted on the thin film heater such that the wire heater is disposed to contact the web.
27. A method of making bags comprising:
   receiving a web;
   forming a single seal on the web using a seal bar on a rotary drum;
   forming a weakened area within the single seal for at least a portion of the time the first seal is being formed.
28. The method of claim 27, wherein forming a weakened area includes forming a perforation.
29. The method of claim 28, wherein forming a perforation includes heating at least one of a wire and a thin web.
30. The method of claim 29, further applying power to the wire using an adjustable voltage.
31. The method of claim 30, further comprising monitoring a signal indicative of heat in the wire and controlling power applied to the wire in response to the signal.
32. The method of claim 31, further comprising pulsing the power.
33. The method of claim 27, wherein forming a weakened area includes forming a line of weakness that varies in intensity.
34. The method of claim 27, wherein forming a weakened area includes separating adjoining bags.
35. The method of claim 28, wherein forming a perforation includes contacting the web with a toothed blade.
36. The method of claim 27, wherein the single seal extends at most 0.25 inches in the machine direction.
37. The method of claim 27, wherein the single seal extends at most 0.125 inches in the machine direction.
38. The method of claim 36, further comprising, independently controlling a plurality of temperature zones when forming the single seal.
39. The method of claim 28, wherein forming the single seal includes applying power to a resistance heater.
40. The method bag machine of claim 39, wherein forming the single seal and forming the weakened area include applying power to a sealing/heating assembly comprised of a first face moved into contact with the web, and further comprised of a double sided tape, a heat conductive layer, and an insulative layer, wherein the insulative layer is between the first face and the heat conductive layer, the heat conductive layer is between the insulative layer and the resistance heater, and the resistance heater is between the heat conductive layer and the double sided tape.
41. The method bag machine of claim 27, wherein forming the single seal and forming the weakened area includes applying power to a sealing/heating assembly comprised of a wire, a releasing layer, and a heat insulating layer, wherein the releasing layer is between the heat insulating layer and the wire, and further includes moving the wire into contact with the web.
42. The method of claim 28, wherein forming a single seal includes bringing at least two parallel sealing subzones into thermal contact with the web, and forming the weakened area includes bringing a weakening zone disposed between the parallel sealing subzones into thermal contact with the web.
43. The method of claim 28 wherein forming a single seal includes forming a first seal portion that extends a first
portion of a distance across the web, and forming a second seal portion that extends across a second portion of the distance across the web.

44. The method of claim 28 wherein forming a single seal includes, wherein the sealing zone includes bringing a wire mounted over the a into contact the web, wherein the releaser is mounted on an insert, and the insert is mounted on a support bar.

45. The method of claim 28 wherein forming a single seal includes, wherein the sealing zone includes bringing a wire mounted on a support bar into contact the web.

46. An apparatus for making bags comprising:

means for receiving a web;

means for forming a single seal on the web, disposed to receive the web from the means for receiving and mounted on a rotary drum;

means for forming a weakened area within the single seal for at least a portion of the time the seal is being formed, mounted on the rotary drum.

47. The apparatus of claim 46, wherein the means for forming a weakened area includes means for forming a perforation.

48. The apparatus of claim 47, further including means for applying power to the means for forming a weakened area at an adjustable voltage.

49. The apparatus of claim 48, further comprising means for monitoring a signal indicative of and controlling the power in response to the monitoring, controllably connected to the means for forming a perforation.

50. The apparatus of claim 49, further comprising means for pulsing the power connected to the means for forming a perforation.

51. The apparatus of claim 46, wherein the single seal extends at most 0.25 inches in the machine direction.

52. The apparatus of claim 46, wherein the single seal extends at most 0.125 inches in the machine direction.

53. A perforator for a rotary bag machine comprising an insert for a rotary drum including a weakening zone within a single sealing zone.

54. The perforator of claim 53, wherein the perforator includes a heating wire.

55. The perforator of claim 54, further comprising a source of power at an adjustable voltage connected to the wire.

56. The perforator of claim 55, wherein the heating wire is disposed to be able to make intermittent contact with a web.

57. The perforator of claim 54, wherein the heating wire is a nickel chromium resistance wire.

58. The perforator of claim 53, wherein the insert is a glass mica ceramic with the wire disposed therein.

59. The perforator of claim 58, wherein the insert has a plurality of holes disposed along a line in the cross direction.

60. The perforator of claim 53, wherein the insert includes a thin film heater.

61. The perforator of claim 53, wherein the insert includes a toothed blade.

62. The perforator of claim 53, wherein the single sealing zone extends at most 0.25 inches in the machine direction.

63. The perforator of claim 53, wherein the single sealing zone extends at most 0.125 inches in the machine direction.

64. The perforator of claim 53, wherein the single sealing zone is comprised of two parallel sealing subzones and the weakening zone is disposed between the two parallel sealing subzones.

65. The perforator of claim 53, wherein the first sealing zone and the weakening zone include a wire, a releasing layer, and a heat insulating layer, wherein the releasing layer is between the wire and the heat insulating layer, and the wire is disposed to comes into contact with the web.

66. The perforator of claim 53, wherein the first sealing zone is mounted on an insert in an aluminum block heater.

67. The perforator of claim 65, wherein the releasing layer is comprised of at least one of teflon, kapton, and rulon.

68. The perforator of claim 67, wherein the insert is comprised of glass mica and has a plurality of holes disposed along a line in the cross direction.

69. The perforator of claim 67, wherein the insulating layer is comprised of at least one of glass therm and mica.

70. The perforator of claim 53, wherein the insert includes a first face disposed to contact the web and is further comprised of a double sided tape having a first side disposed to be affixed to a supporting structure, a resistance heater affixed to a second side of the double sided tape, a heat conductive layer, affixed to the resistance heater, an releasing and electrical insulating layer affixed to the heat conductive layer, and a wire heater affixed to the releasing and electrical insulating layer, wherein the wire heater is disposed to be in thermal contact with the web.

71. The perforator of claim 53, wherein the insert includes a wire, a releasing layer, and a heat insulating layer, wherein the releasing layer is between the wire and the heat insulating layer, and the wire is disposed to comes into contact with the web.

72. The perforator of claim 53 wherein the first sealing zone extends a first portion of a distance across the web, and a second sealing zones extends across a second portion of the distance across the web, wherein the second sealing zone forms two parallel seals and a weakened area disposed between the two parallel seals.

73. The perforator of claim 53 wherein the first sealing zone includes at least two parallel sealing subzones, extending in the cross machine direction, and the perforating zone is disposed between the at least two parallel sealing subzones.

74. The perforator of claim 53, wherein the sealing zone includes a support bar, an insert mounted on the support bar, a releaser mounted on the insert, and a wire mounted over the releaser disposed to contact the web.

75. The perforator of claim 74, wherein the support bar is an aluminum block heater.

76. The perforator of claim 74, wherein the releasing layer is comprised of at least one of teflon, kapton, and rulon.

77. The perforator of claim 53, wherein the sealing zone includes a wire mounted on a support bar and disposed to contact the web.

78. The perforator of claim 53, wherein the sealing zone includes a support bar, a thin film heater mounted on the support bar, and a wire heater mounted on the thin film heater such that the wire heater is disposed to contact the web.

79. The perforator of claim 53, wherein the sealing zone includes a source of hot fluid.

* * * * *