April 9, 1968 G. G. JIANAS 3,376,690

BAG SEALING APPARATUS

Filed April 9, 1965 2 Sheets-Sheet 1

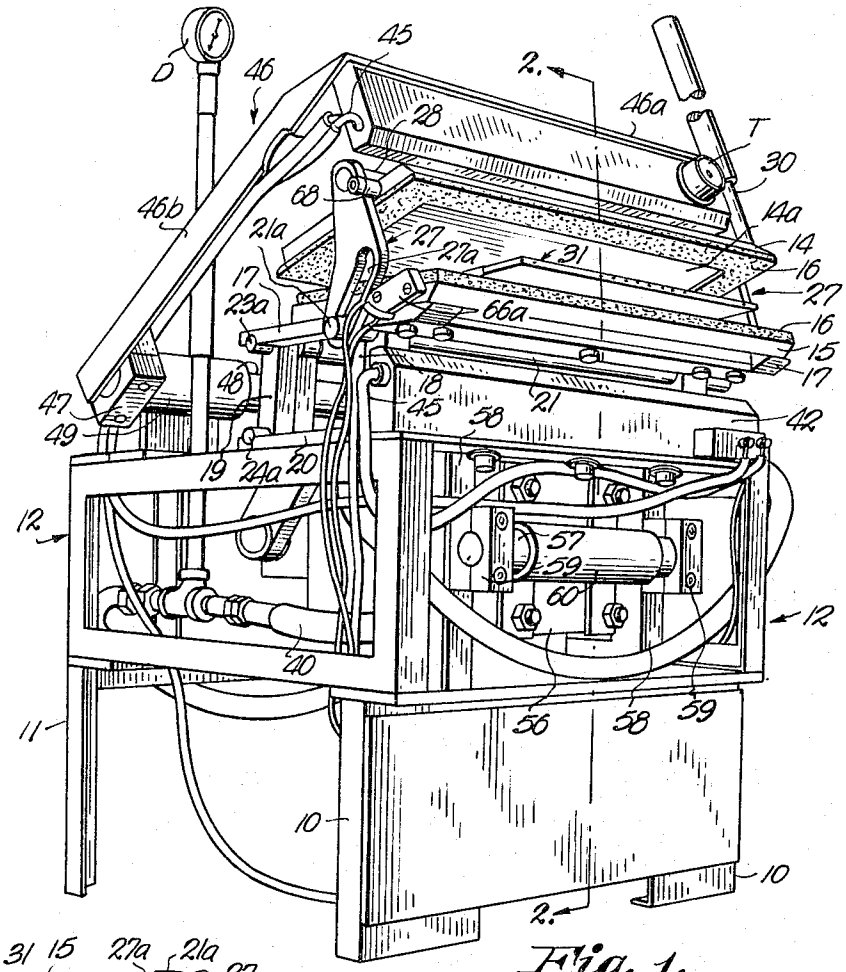


Fig. 1.

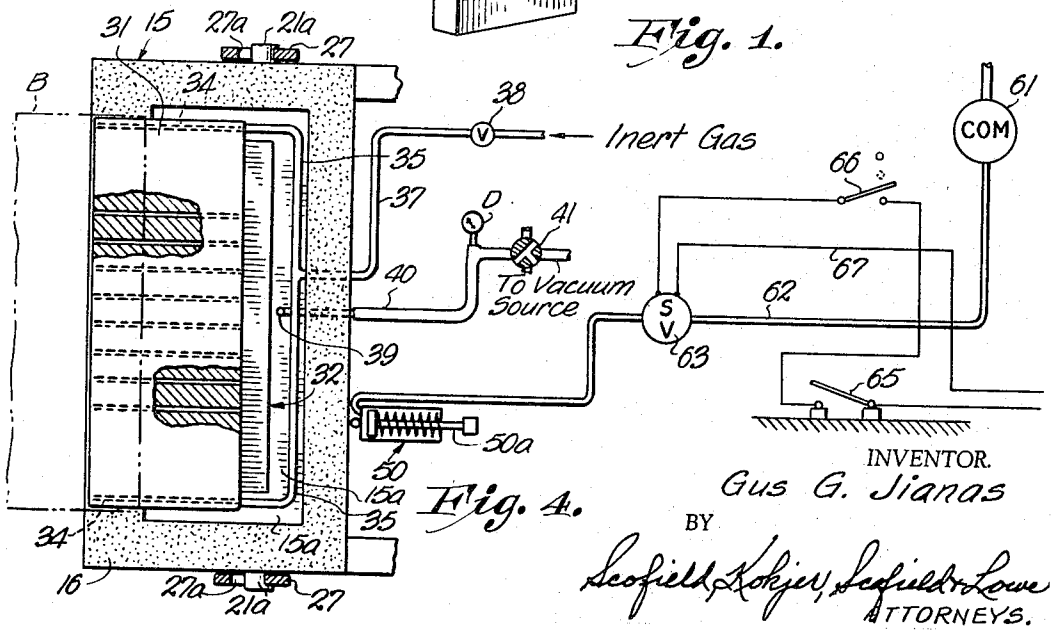


Fig. 4.

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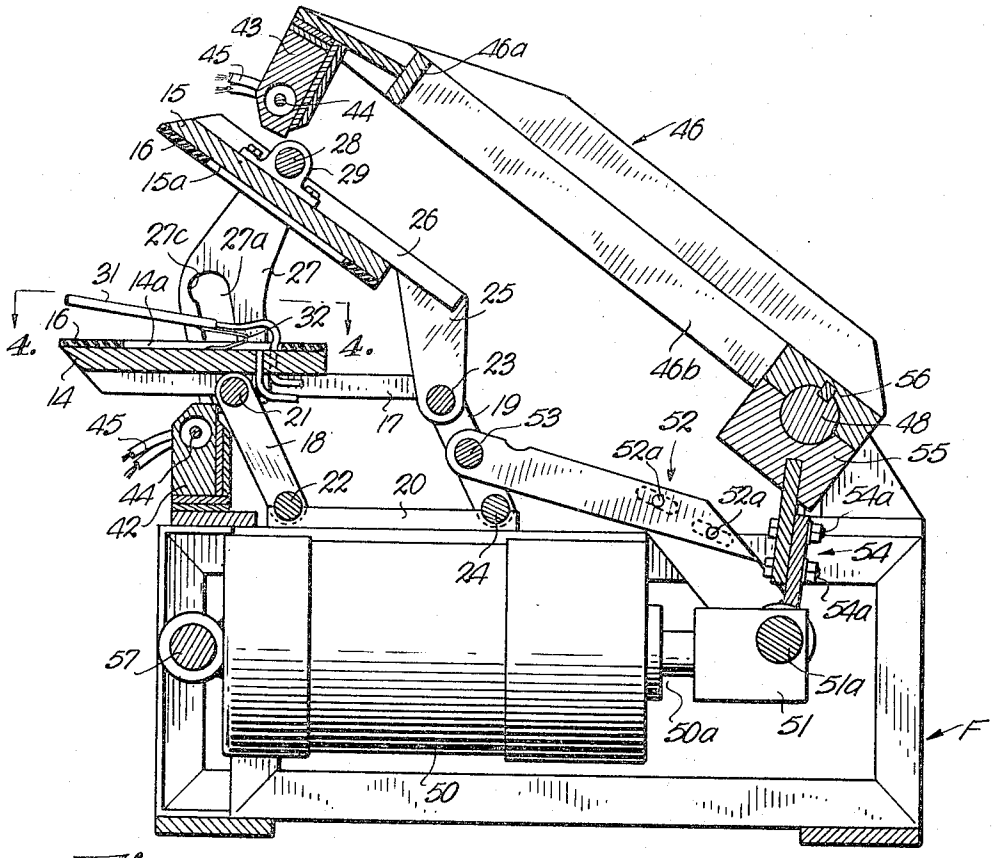


Fig. 2.

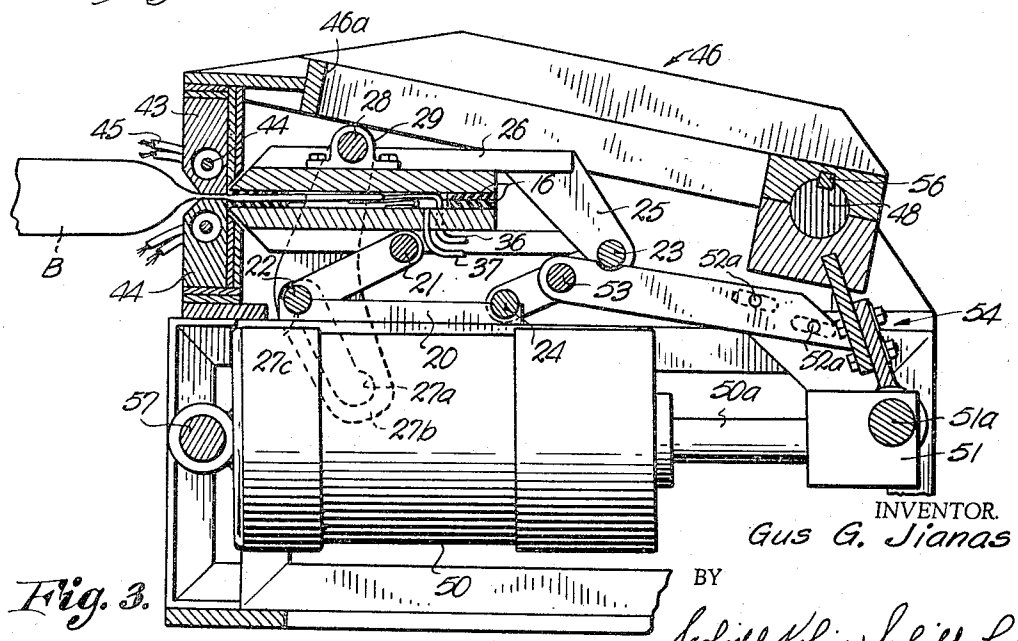


Fig. 3.

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BAG SEALING APPARATUS

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ABSTRACT OF THE DISCLOSURE

The open end of a heat sealable bag is sleeved over a forming member. The forming member is provided with an end to end passageway, the outer end of which is in communication with a chamber formed between two jaws which have deformable portions clamping the bag tightly to and around the forming member. A vacuum pump is connected with the chamber and as the vacuum is imposed, air is evacuated from the chamber and from the bag, the negative pressure within the chamber assisting the clamping action of the jaws around the forming member. Means are provided for flushing the bag with an inert gas and for hermetically sealing the air evacuated, purged bag.

This invention deals generally with the packaging of materials in flexible bag-like containers and refers more particularly to improved apparatus for evacuating air or other gases from the container (and if desired, purging the interior of the container with insert gas) and maintaining a desired internal condition in the container during the application thereto of the hermetic seal.

As indicated in such U.S. patents as Moore 3,150,472, Piazze et al. 2,984,255, Bower 2,672,268, and Rockland et al. 2,875,070, the withdrawing of air from and hermetic sealing of flexible bag-like containers has been dealt with in various ways. In addition, patents such as Moore 2,863,267 teach the principle of evacuating air from such a container and then injecting an inert gas.

The principal problems which are encountered in this art in general are

(1) Achieving and maintaining a sufficiently tight seal around the bag opening during evacuation to insure of a high percentage of air exhaustion without the provision of complex and expensive equipment;

(2) Limiting the quantity of inert gas required to a volume sufficiently low as to make the process effective economically;

(3) Facilitating manipulation of the bags, particularly with reference to properly positioning same for the evacuation and final closing or sealing steps.

In my invention the foregoing problems are all dealt with specifically and I have been able to obtain new results in all of the areas of interest mentioned.

A principal object of the invention is to provide apparatus of the character described wherein during evacuation the bag is clamped between cooperating jaws, which jaws are so designed that the ambient atmospheric pressure cooperates therewith to provide a substantial part of the clamping forces acting to prevent intrusion of air into the bag or the evacuation mechanism. It is a feature of my invention that by virtue of the jaw construction provided, not only is a greater percentage evacuation of air from the bag obtainable, but also I am able to obtain more rapid evacuation for a given bag volume than in many machines.

Another important object of the invention is to provide an arrangement wherein the interior of the bag can be effectively purged with an inert gas while it is held in the clamping mechanism and wherein the quantity of inert gas required to purge the interior of the bag is quite low.

A further object of the invention is to provide apparatus of the character described in which sequential evacuation

and permanent sealing of the bag is achieved in rapid and facile fashion. In my invention the clamping jaws for holding the bag during evacuation and the heated jaws for effecting the closure are linked together and operated by a single power source; in addition, they are so related that the manual steps required in coupling and uncoupling the bag from the unit can be accomplished with very little danger to the operator.

Other and further objects of the invention are to provide apparatus of the character described which is simple in its construction and operation, and can be made available at relatively low cost; that is so constituted as to reduce danger to the operator to a minimum; and to achieve the additional objects and the features appurtenant thereto, appearing in the course of the following description.

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals indicate like parts in the various views;

FIG. 1 is a front perspective view of a typical and preferred embodiment of the invention;

FIG. 2 is a sectional view taken generally along the line 2—2 of FIG. 1, the air, vacuum and gas lines being shown schematically;

FIG. 3 is a view similar to FIG. 2, but showing the clamping and sealing jaws in the closed position which obtains during final heat sealing of the bag; and

FIG. 4 represents a combination of a view taken generally along the line 4—4 of FIG. 2 in the direction of the arrows with a diagrammatic showing of the vacuum, compressed air, inert gas and electrical control systems.

Referring to the drawings, and initially to FIG. 1, the preferred embodiment of the invention comprises a unit which is adapted to be placed upon a table or bench top with the bottom of the unit approximately at waist level so that an operator when standing upright in front of it would be in a comfortable position to operate it. For illustrative purposes, I have shown the unit as having a main frame F which is supported upon front and rear legs **10** and **11**. The frame F is essentially an open box-like frame having the parallel rectangular sides **12**, these being preferably constructed of interconnecting lengths of angle cross section. The unit is essentially symmetrical about a vertical plane extending centrally through the unit from front to back (a plane essentially on the lines **2—2** of FIG. 1), and consequently I have not shown the other side of the unit. It will be understood that basically the other side appears the same as the side seen in FIG. 1.

Supported above the frame F by a means subsequently to be described are the cooperating upper and lower clamping jaws **14** and **15** respectively. These jaws are each rectangular in plan. In the illustrated embodiment, they comprise substantially flat pieces of steel. On their confronting faces they are provided with strips of resilient gasket material **16**. These strips parallel the edges and ends of the plates **14** and **15** and are firmly secured thereto in such a manner as to define confronting rectangular cavities or recesses **14***a* and **15***a*. The gasket material **16** is preferably a closed cell foam rubber having the qualities of low resistance to compressive deformation but good dimensional stability, i.e., resilience.

As can be appreciated by looking at FIGS. 2 and 3 in conjunction with FIG. 1, the lower jaw **15** is carried on a pair of spaced parallel horizontal members **17** forming part of a parallelogram linkage including also the forward links **18**, rearward links **19** and the stationary bottom members **20**. It will be understood that like the upper members **17**, there are pairs of front links **18** and rear links **19** as well as bottom members **20** so that a similar arrangement of members and links is provided at each side of the machine, i.e., the ends of jaw **15**. The

stationary members **20** are carried by and secured to the tops of the respective frame sides **12**.

The links **18** are joined by parallel upper and lower cross rods **21** and **22**, respectively, these rods being secured to and projecting beyond the outside surfaces of the links to provide the projecting portions **21***a* and **22***a* at each end of the rods on the respective opposite sides of the machine. The portions **21***a*, **22***a* are journaled in appropriate recesses formed in the members **17** and **20**. Similar upper and lower rods **23**, **24**, respectively, interconnect the rear links **19** of the parallelogram linkage. Link **23** has the endmost portions as at **23***a* (FIG. 1) which are journaled in appropriate recesses in the underside of the upper horizontal member **17** and the lower cross rod **24** has a similar portion at each end as at **24***a* (again see FIG. 1) which is journaled in the corresponding lower stationary member **20**.

The upper jaw **14** is swingable toward and away from the lower jaw **15** about a pivot axis defined by the longitudinal axis of the rear link rod **23**. A lever arm **25** is journaled on the rod **23**. The upper end of this arm is connected with a member **26** which in turn is secured to the top of the upper jaw **14**. It will be understood that a similar arm **25** and member **26** (not shown) are near the opposite side of the machine from that seen in FIG. 1.

The upper and lower jaws are interconnected also by means of a pair of cam plates **27**, one such plate at each end of the jaw assembly. The cam plates are secured in common to a shaft **28** extending across the upper surface of jaw **14**. This shaft is journaled in spaced bearings **29** affixed to the top of the jaw. At one end the shaft has secured thereto the hand lever **30** which, when the jaws are in the open position as illustrated in FIGS. 1 and 2, is substantially upright or inclined slightly toward the rear of the machine.

The lower portions of cam plates **27** have slots **27***a* therein in which are received the projecting portions **21***a* of the rod **21**. The slot **27***a* is essentially straight, although it is provided at its opposed ends with oppositely facing indentations or notches **27***b* and **27***c* in the side edges. These notches serve to cooperate with rod portions **21***a* to releasably maintain the jaws in the open or closed condition, as the case may be.

Turning now to FIG. 4 in conjunction with the other figures, it will be observed that supported adjacent the upper side of the lower jaw **15** is a long thin substantially flat rectangular member **31**. This member is preferably constructed of metal and is of lesser strength than the overall length of the upper and lower jaws. It is carried by and extends forwardly in cantilever fashion from the upper leg of a leaf spring **32**. The leaf spring is substantially V-shaped in cross section and its other leg is welded or otherwise firmly secured to the lower jaw **15** within the cavity **15***a*. The leaf spring **32** is so formed that the member **31** is firmly but resiliently held in slightly upwardly and forwardly inclined position with its forward end (that end opposite the spring) spaced well above the gasket material **16** on the lower jaw. As can be seen in FIG. 2, the forward end of the member **31** is so located that if pressed down toward the lower jaw **15** (as is the case in FIG. 3) it will be very close to if not slightly beyond the outside edge of gasket material. The reason for this will subsequently be made clear.

The member **31** is provided with a plurality of front to rear passageways **33** which open at their opposite ends in the front and rear edge surfaces of the member **31**. The passageways are parallel and preferably there are more than three, the present embodiment being shown with eight. Near the endmost edges additional passageways **34** are provided, these also having end openings in the front and rear edges of the member **31**. The rear openings of these passageways **34** are connected respectively with lengths of flexible tubing **35** which proceed to a Y which in turn is connected with a passageway **36** through the bottom jaw **15**. This passageway has connected with it a further tube **37** which leads from a source of inert gas. A valve **38** is interposed in the line **37** so that the flow of inert gas can be regulated.

A second passageway **39** is provided through the lower jaw **15** substantially at the rear center portion of the recess **15***a*. With this passageway is connected a line **40** which leads to a source of vacuum, such as a vacuum pump (not shown). A three-way valve **41** which may be manually or electrically controlled, is interposed in vacuum line **40**. The valve control means, whether manual or electric, is positioned for easy access by the operator. A vacuum gauge D connects with line **40**, and as can be seen in FIG. 1, is readily visible to the operator.

Located below a lower jaw **15** is a sealing or die member **42** which cooperates with an upper die **43** in a manner subsequently to be described to form a line seal across the bag following the evacuation of air from it. The sealing dies are constructed of material having good heat conductivity and are heated by means of electric heater elements **44** disposed in longitudinal bores formed in the respective die members. The electrical conductors to the respective heat elements are shown at **45**. A thermometer T may be included on the upper or lower die as seen in FIG. 1.

In the preferred embodiment, the lower die **42** is stationary, being supported on the front top edge of frame F. The upper die **43** is carried at the rear of a pivotal arm **46** constructed in the form of a rectangular frame structure having the forward cross member **46***a* and parallel side members **46***b*, only one of which is seen in FIG. 1. On each side of and at the rear of the arm **46** are located connector block assemblies **47** which join the sides **46***b* of the arm to a horizontal shaft **48**. The shaft **48** is in turn journaled in spaced bearings **49** supported on the rear of the frame F, one adjacent each side of the frame.

The upper sealing die **43** is pivoted about the axis of shaft **48** by means of an air cylinder **50** having the extending piston rod **50***a*. A connecting block **51** is secured to the end of piston rod **50***a* and this in turn is pivotally connected to a horizontal axle **51***a* on which is pivoted one end of a forwardly extending link **52**. The other end of link **52** connects with a rod **53** extending between and secured to the rear links **19** of the parallelogram linkage earlier described.

It will be observed that an arm **54** is also pivoted on axle **51**, which arm is joined with a block assembly **55** keyed as at **56** to the shaft **48**.

Both the arm **54** and link **52** are two-part in construction. The respective parts are connected through the use of elongated slots in one which receive pins **52***a* and **54***a* respectively, to permit the necessary shortening and lengthening of the arm and link respectively during operation of the mechanism.

The forward end of the air cylinder **49** is pivotally supported on a horizontal shaft **57** which is secured at its ends to vertical frame components **58** by blocks **59**. A sleeve **60** secured to the end of the piston rotatably encircles the shaft and provides the pivotal support.

The control system for the air cylinder is shown schematically in FIG. 4. The piston is a single acting cylinder with the piston spring biased toward the retracted position illustrated in FIG. 2. The cylinder is connected with a compressor **61** or other source of compressed air by a line **62** in which is interposed a two-way solenoid actuated valve **63**. The valve **63** is contained in an electric circuit comprising conductor **64**, normally open foot switch **65**, normally open safety switch **66**, and return conductor **67**. Conductors **64**, **67** are connected with a suitable source of electrical energy (not shown).

The foot switch **65** is a pedal or treadle type switch and is located in a position convenient to the foot of an operator for the machine when an operator is in position to operate it. The safety switch **66** which is in series with the foot operated switch comprises a microswitch body **66***a* (see FIG. 1) mounted at one end of

the lower jaw **15** with the contact arm **66***b* of the switch positioned in the path of a pin **68** extending from the near end of the upper jaw **14**. The location of the switch arm relative to the pin is such that when the jaw **14** is clamped tightly down upon jaw **15**, the switch will be closed.

In preparing the machine for operation, the vacuum valve **41** is in its neutral position with the line **40** in communication with the atmosphere. Valve **38** in the gas line **37** is also closed. The solenoid valve **63** is in a condition wherein it shuts off communication of pressure to the cylinder **49** so that the piston thereof is retracted. The unit is shown in FIGS. 1 and 2 as ready for reception of a bag, the evacuation of air therefrom, and sealing.

In operating the machine, a bag of the type generally indicated in the patents listed earlier is brought into position adjacent the front of the machine and its open mouth is fitted over the member **31** as indicated in FIG. 4, the bag being partially shown in broken lines at B. Preferably the length of the member **31** from one end seam to the other is just slightly less than width in the same direction of the bag, so that when fitted over the member **31** the bag is stretched, at least at its mouth portion, to substantially its fully extended width. The opposed plies of the bag thus lie relatively smoothly on the opposite sides of the member **31**.

When the bag is properly positioned, as described above, the operator grasps the operating handle **30** and pulls forwardly on it. This results in bringing the upper jaw **14** down upon the lower jaw since as earlier explained, the slots **27***a* of the cams **27** coact with the shaft end portions **21***a* during rotation of the handle to draw the upper jaw toward the lower jaw. As the jaws close upon one another the sealing gaskets **16** will register with one another and will compress thus forming a tight contact seal against the outer bag surfaces and around the edges of the bags at the ends of the member **31**. Vacuum valve **41** is then positioned to impose a vacuum on line **40**. The seal is sufficiently tight to exclude any flow of air from outside the jaw cavities **14***a*, **15***a*, thereinto. Thus the entire vacuum imposed upon the line **40** is transmitted to the internal chamber formed by cavities **14***a*, **15***a*, and through the passageways **33** in the member **31** to the interior of the bag. All air in the bag is thus quickly drawn from the bag through passageways **33** into the sealed chamber formed by recesses **14***a*, **15***a*, and thence through port **39** into and through the vacuum line **40**. By observing the dial D, the operator can visually determine the vacuum being drawn and obviously can stabilize it at any point desired by shifting valve **41** to the hold position, in which the line **40** is shut off from both the atmosphere and vacuum source.

As earlier noted, since the handle **30** has been pulled to its full forward position, the indents **27***b* at the ends of the cam slots **27***a* will engage with the shaft portions **21***a* to releasably lock the jaws in the closed, vacuum imposing position. The operator's hands are now free for subsequent operation. It is important to observe that by virtue of providing the large cavities **14***a*, **15***a* which together form a chamber when the jaws are closed, I am able to obtain advantage of atmospheric pressure in holding the jaws together. In other words, supplementing the downward pull exerted by the handle and the camming members **27** is an atmospheric pressure of normally 14.7 pounds per square foot. The greater the suction or vacuum force on line **40**, the more tightly the jaws will be forced together, thus assisting materially in obtaining an airtight seal between the gasket sections **16**.

In the event it is desired to purge or wash the contents of the bag with an inert gas, a charge of inert gas is delivered to the bag by opening valve **38** in the gas line **37**. The gas flows into the branch lines **35** and through the passageways **34** in member **31** into the bag. If it is desired to keep the inert gas in the bag, the bag can be sealed at this point. However, if the gas is simply for washing purposes, it can then be evacuated by closing gas valve **38** and reopening the vacuum valve **41**.

When the bag has properly been evacuated and, if desired, reconditioned or purged with inert gas, it is ready for sealing. To accomplish the sealing, the operator simply depresses the treadle of the foot switch **65** to close the contacts thereof. Since the closing of the bag clamping jaws **14**, **15** has closed the safety switch **66** by engagement of pin **68** with the arm **66***b* of the switch, a circuit is completed through the solenoid valve **63**, and the valve opens communication of pressure to the air cylinder **49**. This, of course, results in extension of the piston rod **50** with the following results.

As the piston rod extends it serves to swing the arm **46** carrying the upper sealing die **43** about the axis of the shaft **48** thus closing the die **43** toward the stationary die **44**. At the same time the link **52** serves to apply clockwise pivoting force on the rear links **19** of the parallelogram linkage to which the clamping jaws are affixed, thus shifting the clamping jaws to the right from the FIG. 2 to the FIG. 3 position. The displacement of the jaws draws the bag with them and the relationship of the parts is such that the clamping jaws **14**, **15** are retracted just far enough to permit the dies **43**, **44** to come together and tightly engage the bag therebetween adjacent the forward edge of the clamping jaws. The heated die members **43**, **44** serve to join the plies of the bag together to form a tight sealed closure in the usual manner.

Upon release of the foot switch **65**, the circuit is broken and the spring within the cylinder **50** causes the piston to retract thus returning the parts to the FIG. 2 position. It will be understood, of course, that the jaws **14**, **15** remain closed under the influence of the vacuum still being imposed and as supplemented by the lock arrangement provided in cam slots **27***a*.

To release the bag from the jaws, the operator shifts vacuum valve **41** to neutral and pushes the handle **30** back toward the rear of the machine, thus rotating the cams **27** and reopening the jaws **14**, **15**. The bag can now be removed and another placed in the unit for evacuation and sealing.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In apparatus for removing air or other gases from the interior of a flexible bag having an open end, the combination of

a pair of clamping jaws having open and closed positions with respect to each other, said jaws having cooperating resilient sealing surfaces which define, when the jaws are closed, a chamber therebetween,

a substantially flat, thin bag forming member carried by one of said jaws and positioned to be clamped with a bag partially sleeved thereover between said sealing surfaces, said bag forming member having an outer edge and an inner edge, the inner edge exposed to said chamber,

at least one passageway through said bag forming member having end openings respectively in said inner and outer edges, and

means for withdrawing air from said chamber.

2. In apparatus as in claim 1,
said sealing surfaces defined by confronting registering ring-like structures.

3. In apparatus as in claim 1,
a resiliently yieldable support element connecting said bag forming member with said one jaw, said element and forming member so arranged that when said jaws are in said open position, said forming member is spaced away from each jaw and the sealing surfaces therefor.

4. In apparatus as in claim 1,
lever actuated means operable to open and close said jaws, and
releasable locking means operable automatically to lock said jaws in said closed position in response to closing thereof.

5. In apparatus as in claim 1,
a pair of heat sealing members normally positioned above and below said jaws and movable relatively toward one another to engage a bag portion therebetween,
power means for so moving said heat sealing members, and
means operable to retract said jaw members from the path of said sealing members responsive to said power means.

6. In apparatus as in claim 3,

said support element comprising a reversely bent leaf spring, one end of which is anchored to said jaw, and the other end connected with said bag forming member.

7. In apparatus as in claim 1,
said bag forming member having a plurality of side by side substantially parallel passageways, each open at the inner and outer edges of said member.

8. In apparatus as in claim 7,
one of said passageways having connected with its opening on the inner edge a line for communicating a fluid thereto.

9. In apparatus as in claim 1,
said means for withdrawing air comprising a source of vacuum and valve means operable selectively to connect said chamber with said source and the atmosphere.

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