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(56) Documents Cited:
GB 2257387 A **US 6623588 B1**
US 4249975 A

(58) Field of Search:
INT CL **A61F, B29C**
Other: **ONLINE: WPI EPODOC**

(54) Abstract Title: **Moulding and sealing a fluid bag formed by two sheets**

(57) A method of enveloping a fluid 90, to make a product which is normally a silicone bag, Features the pouring of a fluid 90 into a concavity of a bottom sheet 91, mounted on a moulding press 41. The bottom sheet 91 and a second sheet 92 are bought together in a vacuum chamber and sealed together by upper and lower heated plates 41,42. Also disclosed is a corresponding apparatus for carrying out the method. The apparatus may feature various parameter controls for the heating of the moulding plates, and parameters of the vacuum in the vacuum chamber.

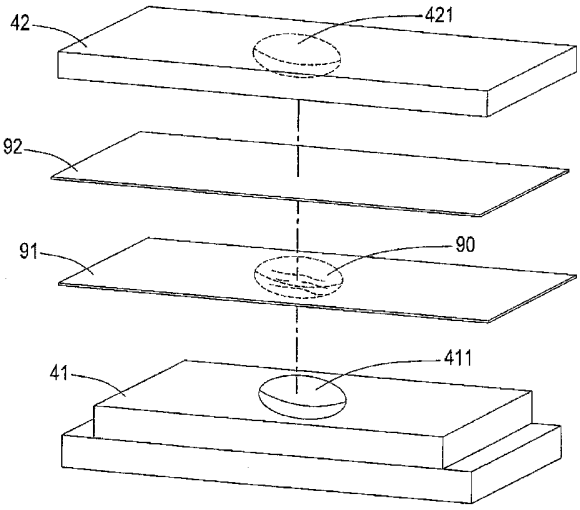

FIG.3

GB 2 453 124 A

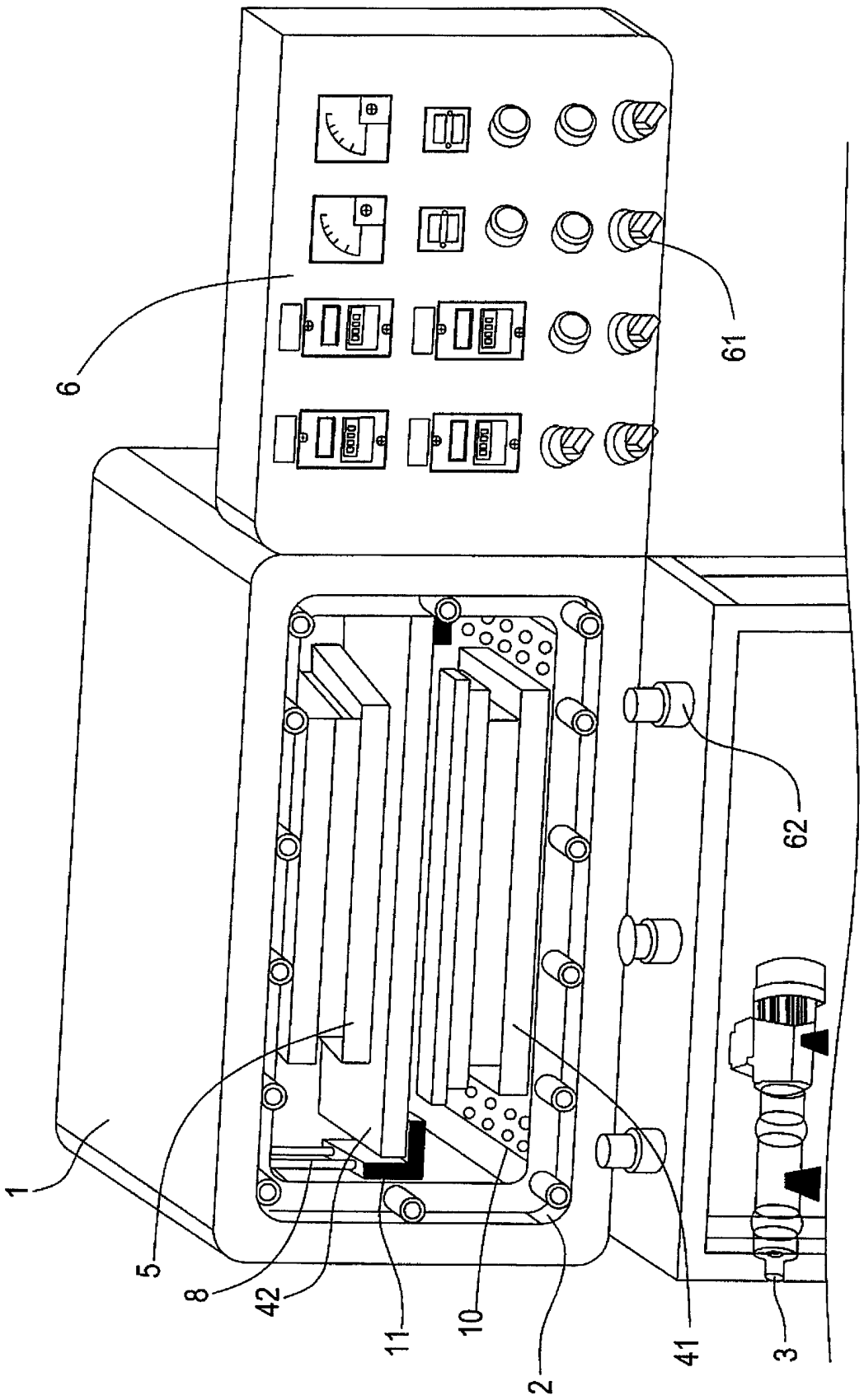

FIG.1

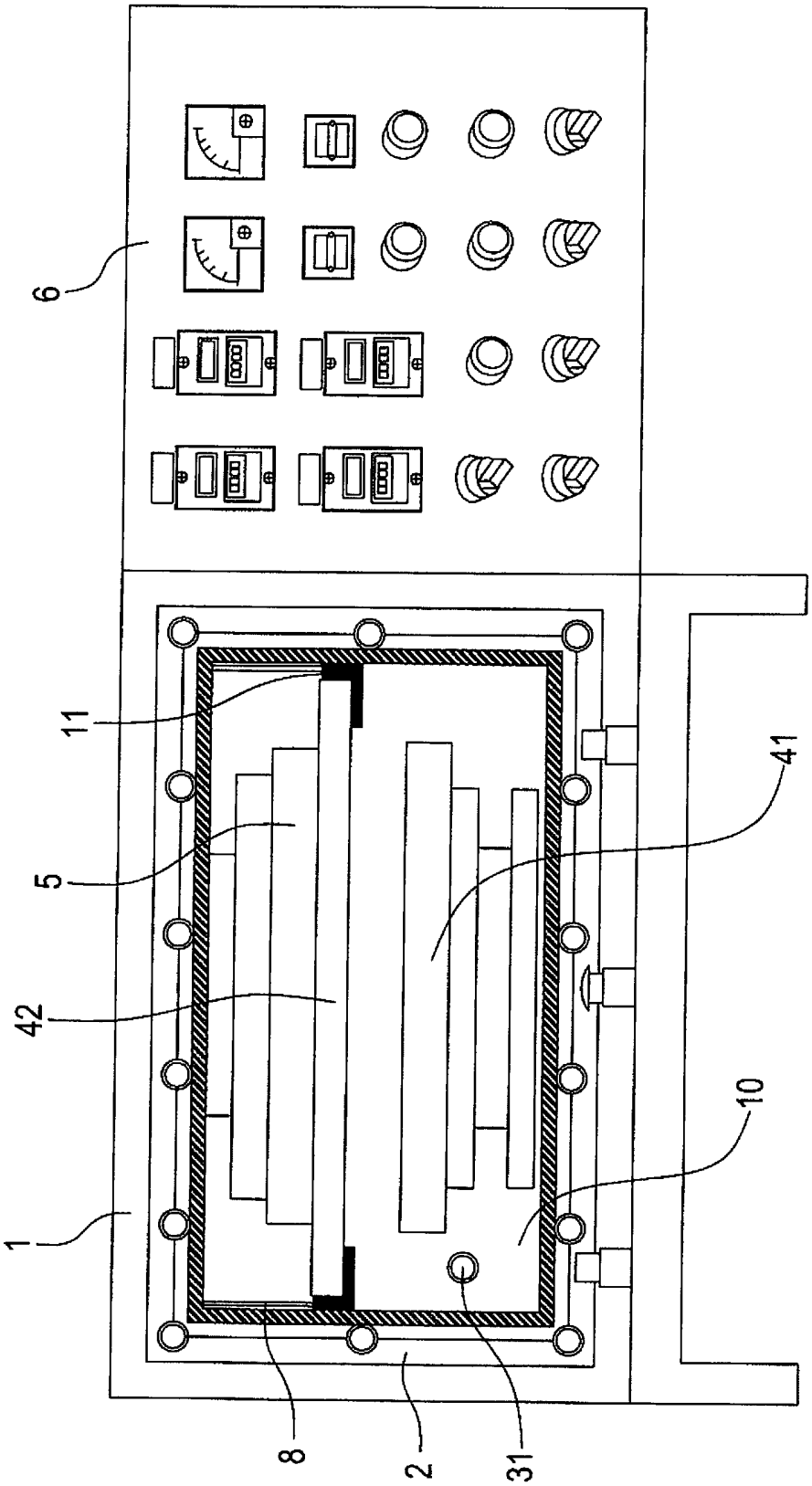

FIG.2

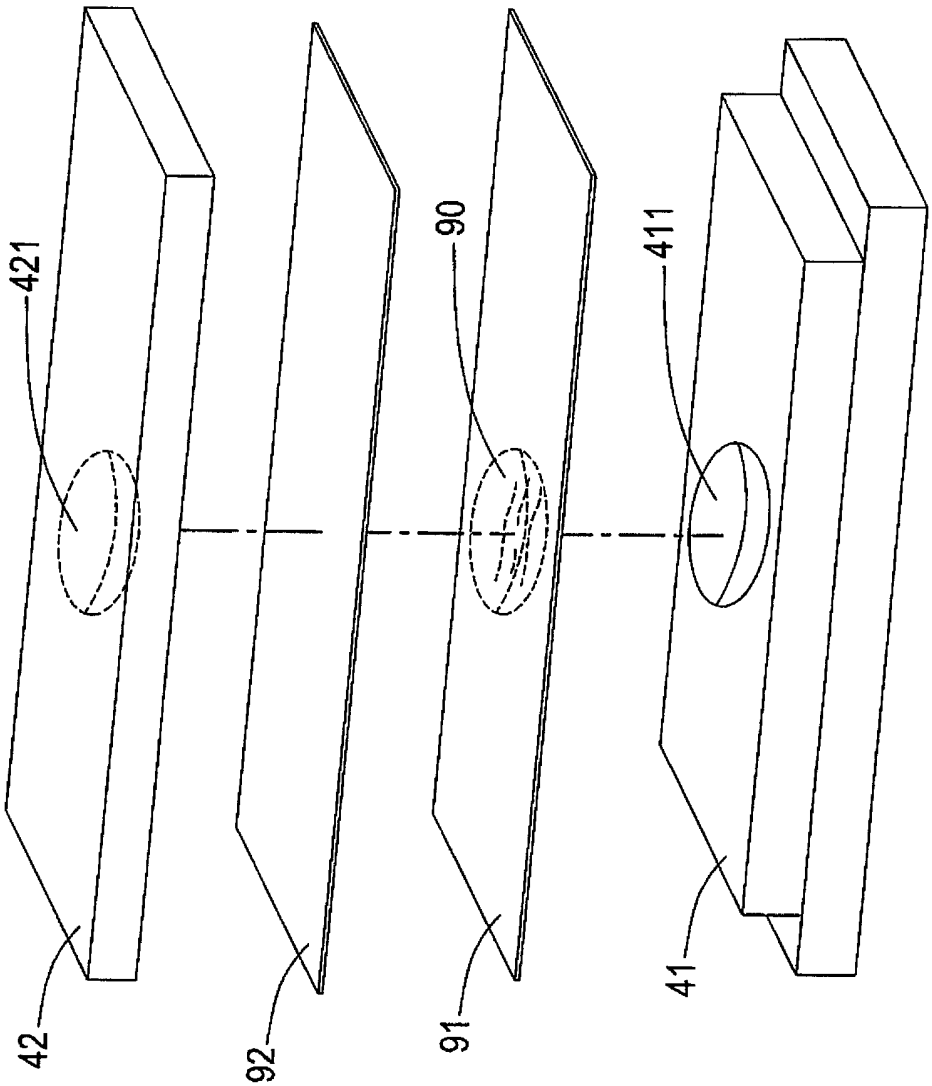

FIG.3

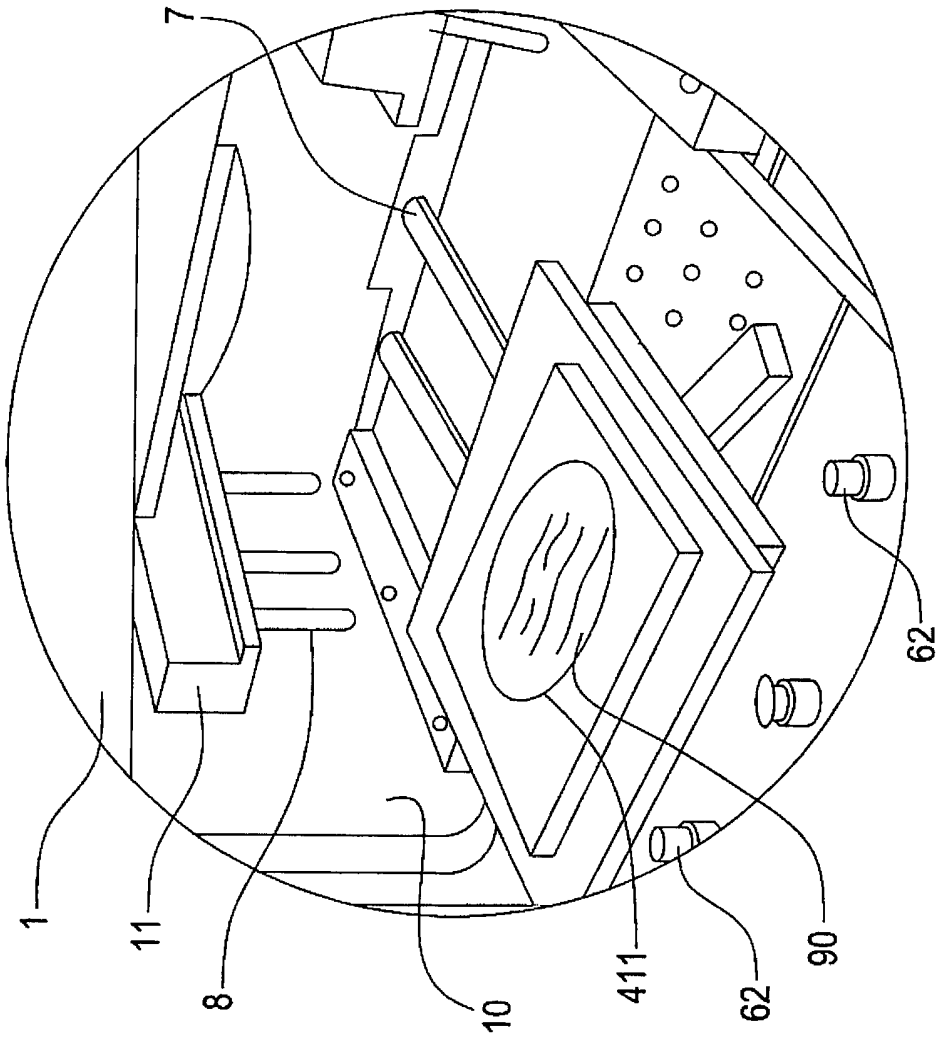

FIG.4

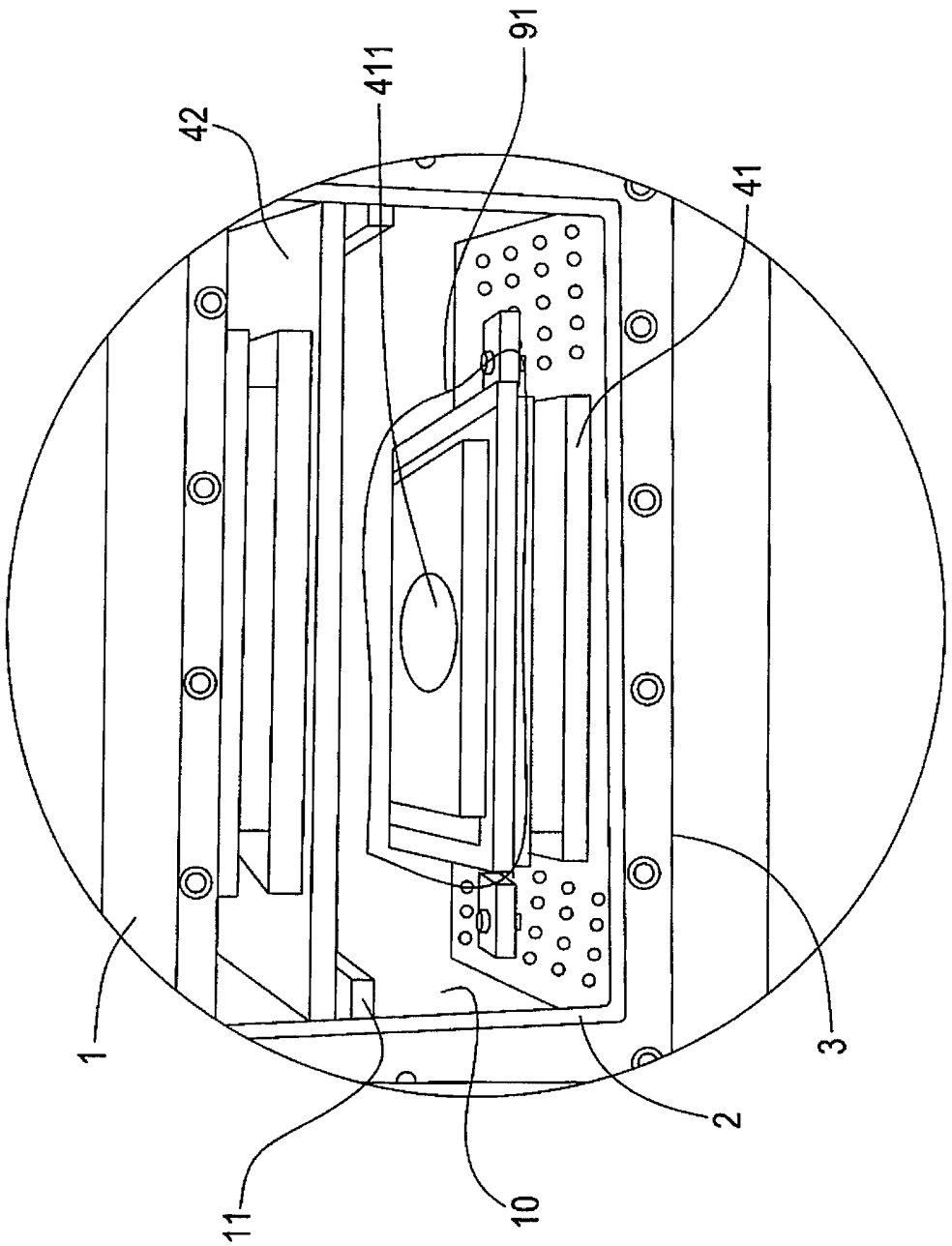

FIG.5

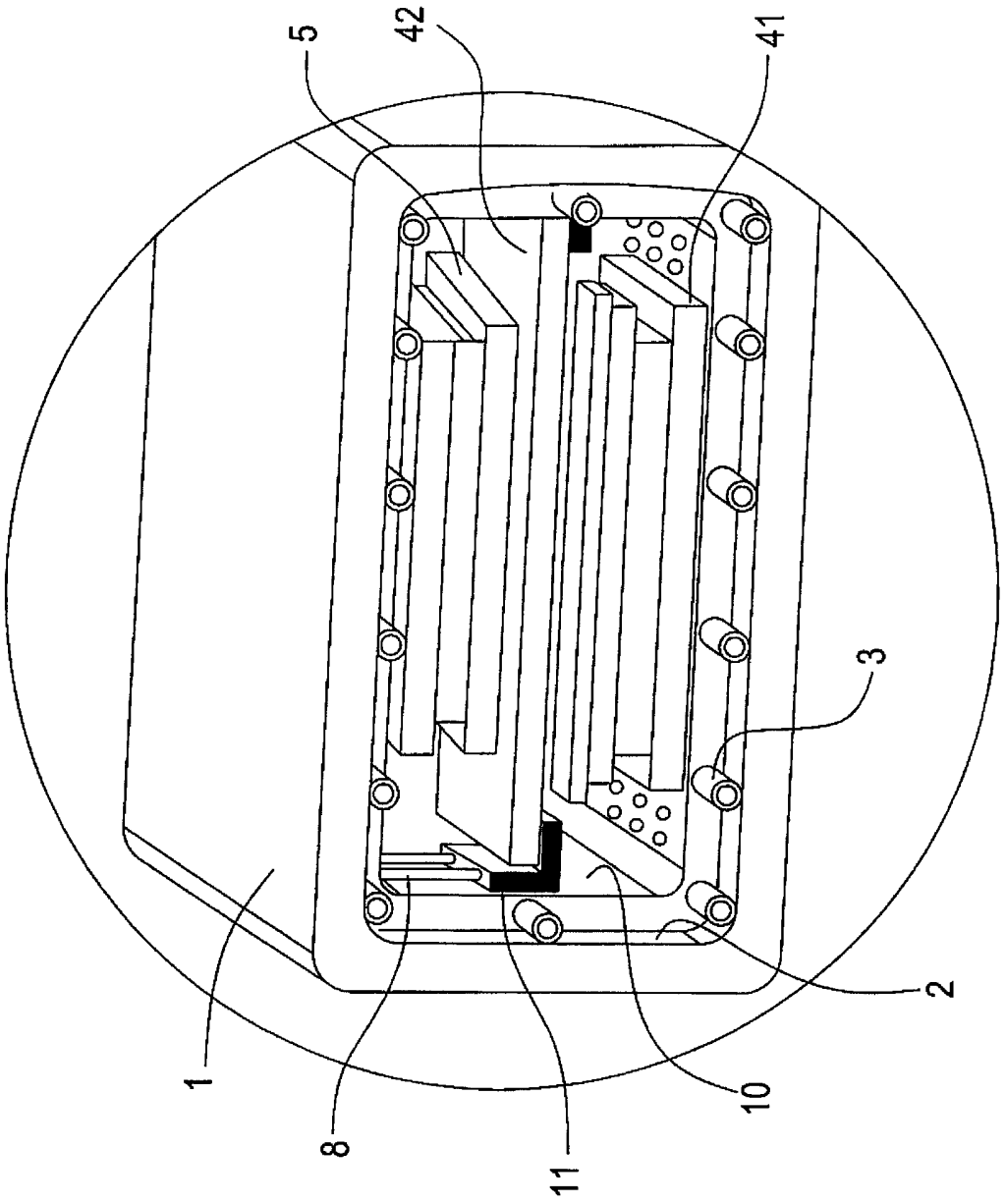

FIG.6

FLUID ENVELOPING DEVICE AND METHOD FOR ENVELOPING FLUID WITH THIN FILMS

BACKGROUND

[001] The present invention relates to an enveloping device and method for enveloping fluid, and in particular to an enveloping device and a method for enveloping fluid under a vacuum environment with hot-press enveloping device.

[002] A conventional method for enveloping silicone gel with plastic films is normally performed in an atmospheric environment, which includes the following steps: firstly, combining two plastic films into a bag like enclosure with an opening by a film welding machine; secondly, pouring silicone gel into the enclosure from the opening to fill the silicone gel with air; thirdly, continuously expelling bubbles and the air out of the enclosure through the opening by manually squeezing the enclosure with the silicone gel; finally, closing the opening by the film welding machine after the bubbles and the air are totally expelled from the enclosure so as to complete the operation of enveloping the silicone gel with the plastic films. However, the above-mentioned conventional method needs to perform two-stage welding procedures and it wastes too much manpower and time. Thus, the manufacturing cost is higher.

[003] Since the enveloping of silicone gel is performed in the atmospheric environment, which leads the problem of the bubbles and the air existed in the enclosure when filling in the silicone gel, a lousy work has to follow for expelling the bubbles and the air. Such procedure further brings the following extra shortcomings: a poor yield of product; difficult to isolate bacterial contamination; incompletely cleaning of the bubbles and the air causing separation of the silicone gel from the contact surfaces of the films under an abnormal circumstance, such as during air transportation, which degrades the stability, quality and yield of the product.

[004] For these defects inevitably brought on the prior art, an improvement is seriously required.

[005] The applicant has plunged into the matter for years to studying and improving these defects and come up with a novel method and product of enveloping fluid with films as provided in this invention to eliminate the defects mentioned above.

[006] These features and advantages of the present invention will be fully understood and appreciated from the following detailed description of the accompanying Drawings.

BRIEF SUMMARY

[007] An exemplary fluid enveloping device includes a housing having a vacuum chamber; a valve for blocking off the communication of the vacuum chamber and atmospheric environment; a vacuum pump module connected to the vacuum chamber for extracting air until the vacuum chamber is close to a vacuum state; a die holder for locating a lower thin film and receiving the fluid at the lower thin film; a punch holder for locating an upper thin film; and a sealing nip in the vacuum chamber for hot-pressing the upper and the lower thin films to envelope the fluid therein. The enveloping of the upper and the lower thin films just needs once hot-press enveloping process and no bubbles exist therein.

[008] The fluid can be silicone gel or silicone rubber or high temperature vulcanize (HTV) rubber or their combination.

[009] The die holder can be disposed out or in the vacuum chamber when the fluid is poured thereat. The sealing nip can be located above the punch holder or under the die holder. The sealing nip can operate by hot melting adjoining method, ultrasonic adjoining method or high-frequency adjoining method for hot-press enveloping fluid. In addition, the vacuum pump module includes at least one air vent for extracting air until the vacuum chamber is close to a vacuum state or filling air into the vacuum chamber to relieve vacuum state.

[0010] The fluid enveloping device further includes a moving module for driving the die holder to move in and out the vacuum chamber, and further includes at least one lifting module in the vacuum chamber for driving the punch holder and the sealing pin to move down to contact

join with the die holder, or at least one lifting module in the vacuum chamber for driving the die holder and the sealing pin to move up to contact join with the punch holder.

[0011] Moreover, the fluid enveloping device further includes an operation module, which is used to adjust the all kinds of air pump characteristics of the vacuum pump module or all kinds of hot-pressing characteristics of the sealing nip, and further includes two safety switches, which are pressed simultaneously, the valve can be turned on or turned off.

[0012] An exemplary method of enveloping fluid includes: step a: locating an upper thin film at a punch holder; step b: locating a lower thin film at a die holder; step c: pouring a fluid at the lower thin film; step d: sealing a vacuum chamber having the punch holder and the die holder; step e: extracting the air in the vacuum chamber out until the vacuum chamber is close to a vacuum state; step f: driving the punch holder and the die holder to corresponding positions for contact joint; and step g: hot-pressing the peripheral circumferences of the upper and lower think films for enveloping the fluid therein in a vacuum condition. The enveloping of the upper and the lower thin films just needs once hot-press enveloping process and no bubbles exist therein.

[0013] The fluid can be silicone gel or silicone rubber or high temperature vulcanize (HTV) rubber or their combination.

[0014] The step of pouring the fluid at the lower thin film can be operated in or out the vacuum chamber. The hot-press enveloping method can be hot melting adjoining method, ultrasonic adjoining method or high-frequency adjoining method for hot-press enveloping fluid. After the step g, the method further includes further a step of the vacuum state of the vacuum chamber being released for taking out the enveloped product.

[0015] In step f, the die holder can be driven to move up to splice with the punch holder, or the punch holder is driven to move down to splice with the die holder.

[0016] In the method, a valve is provided to block off the communication of the vacuum chamber and atmospheric environment in step d. Thus, the method further includes a step of

simultaneously pressing two safety switches for turning on or turning off the valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] These and other features and advantages of the various embodiments disclosed herein will be better understood with respect to the following description and drawings, in which like numbers refer to like parts throughout, and in which:

[0018] Figure 1 is a schematic, isometric view of a fluid enveloping device according to a preferred embodiment of the present invention;

[0019] Figure 2 is plan view from another viewing angle of the fluid enveloping device of Figure 1;

[0020] Figure 3 is a schematic view showing a method for enveloping fluid according to a preferred embodiment of the present invention; and

[0021] Figure 4 through Figure 6 show main steps of the method of Figure 3.

DETAILED DESCRIPTION

[0022] As shown in Figures 1 and 2, an enveloping device according to a preferred embodiment of the present invention is disclosed. The enveloping device includes a housing 1, a valve 2, a vacuum pump module 3, a die holder 41, a punch holder 42, a sealing nip 5, and an operation module 6.

[0023] The housing 1 is box like configuration, which has a vacuum chamber 10 and a supporting carriage 11 received in the vacuum chamber 10.

[0024] The valve 2 is used to seal the housing 1 for closing the vacuum chamber 10 and blocking off the communication of the vacuum chamber 10 and atmospheric environment.

[0025] The vacuum pump module 3 connected to the vacuum chamber 10 includes at least one air vent 31 for extracting atmosphere until the vacuum chamber 10 is close to a vacuum state,

or filling atmosphere into the vacuum chamber 10 to relieve the vacuum state.

[0026] The die holder 41 is disposed outside the vacuum chamber 10, which includes a first die cavity 411. The die holder 41 is used to locate a lower thin film 91 and the fluid 90 is received at the lower film 91.

[0027] The punch holder 42 includes a second die cavity 421 for locating an upper thin film 92, which the upper thin film 92 has a peripheral circumference corresponding that of the lower thin film 91.

[0028] The sealing nip 5 is disposed one the supporting carriage 11 in the vacuum chamber 10. The sealing nip 5 is used to hot-press the peripheral circumferences of the lower and the upper thin films 91, 92 for enveloping the fluid 90 therein, by a hot melting adjoining method.

[0029] The operation module 6 disposed one side of the housing 1 has a plurality of operating buttons 61 and two safety switches 62. The plurality of operating buttons 61 can be operated by an operator for adjusting the air pump characteristics of the vacuum pump module 3 and hot-pressing characteristics of the sealing nip 5. The two safety switches 62 are used to assure the safe operation of the enveloping device. When the two safety switches 62 are pressed at the same time, the valve 2 can be turned on or turned off. When the valve 2 is turned on, the enveloping device can start up. Thus, the enveloping device can assure an operator safely operating it, and prevent the valve 2 from pressing the operator and improve the security.

[0030] The enveloping device further includes a moving module 7 for driving the die holder 41 to move in and out the vacuum chamber 10, and at least one lifting module 8 in the vacuum chamber 10. The at least one lifting module 8 is used to realize the contact joint of the die holder 41, the punch holder 42, and the sealing nip 5. When one lifting module 8 drives the punch holder 42 to move down or up, another lifting module 8 is provided to drive the sealing nip 5 move down or up too. In addition, the number of the lifting module 8 can be only one, which can respectively control the movement of the punch holder 42 and the sealing nip 5.

[0031] In the above mentioned operation module 6, the adjustable air pump characteristics of the vacuum pump module 3 include the vacuum releasing time, vacuumizing time, and etc. The hot-pressing characteristics of the sealing nip 5 include the hot-pressing time, hot-pressing temperature. In addition, the operation module 6 can turn on or turn off the moving module 7 and control the moving distance of the moving module 7.

[0032] Referring to Figures 3 through 6, the operator firstly puts the upper thin film 92 in the second die cavity 421 of the punch holder 42, and puts the punch holder 42 on the supporting carriage 11 of the vacuum chamber 10, and then locates the lower thin film 91 on the first die cavity 411 of the die holder 41 and pours the fluid 90 at the lower thin film 91. After the process of pouring fluid is finished, the operator should start the moving module 7 to drive the die holder 41 to move in the vacuum chamber 10 and turn on the valve 2 for sealing vacuum chamber 10 of the housing 1. After that, the operator can utilize the vacuum pump module 3 to extract the air according to the presetting characteristics until the vacuum chamber 10 is close to a vacuum state, where no gas exists in the fluid 90. And then, the operator starts up the lifting modules 8 to drive the punch holder 42 and the sealing nip 5 to move down until the punch holder 42 touches the die holder 41. At the same time, the sealing nip 5 hot-presses the peripheral circumferences of the upper and the lower thin films 91, 92 for enveloping the fluid 90 therein. No bubbles exist in the fluid 90. Finally, the vent hole 31 of the vacuum pump module 3 fills gas into the vacuum chamber 10 to release the vacuum state, and the valve 2 opens the housing 10 to release closing state of the vacuum chamber 10, and the moving module 7 drives the die holder 41 to move out from the vacuum chamber 10. Thus, the hot-press enveloping product can be taken out.

[0033] In alternative embodiment, the die holder 41 can firstly be moved in the vacuum chamber 10, and then the fluid 90 can be poured at the lower thin film 91. After that, the operator can utilize the vacuum pump module 3 to extract the air according to the presetting characteristics until the vacuum chamber 10 is close to a vacuum state. In addition, the sealing nip 5 can also be

disposed under the die holder 41 for hot-press enveloping the upper and the lower thin films 92, 91.

[0034] The method for enveloping fluid with thin films includes the following steps.

[0035] Step a: the upper thin film 92 is disposed at the punch holder 42.

[0036] Step b: the lower thin film 91 is disposed at the die holder 41.

[0037] Step c: the fluid 90 is poured at the lower thin film 91. The step of pouring the fluid 90 can be operated out or in the vacuum chamber 10. If the process of pouring the fluid 90 is operated out the vacuum chamber 10, the moving module 7 drives the die holder 41 in the vacuum chamber 10 after the process is finished. If the process of pouring the fluid 90 is operated in the vacuum chamber 10, the moving module 7 drives the die holder 41 in the vacuum chamber 10 before the process starts up.

[0038] Step d: the vacuum chamber 10 having the punch holder 42 and the die holder 41 is sealed. The operator turns on the valve 2 for sealing vacuum chamber 10 and blocking off the communication of the vacuum chamber 10 and atmospheric environment, when the two safety switches 62 are simultaneity pressed down. Thus, the two safety switches 62 assure an operator safely operating it, and prevent the valve 2 from pressing the operator and improve the security.

[0039] Step 5, the air in the vacuum chamber 10 is extracted out until the vacuum chamber 10 is close to a vacuum state. The operator can utilize the vacuum pump module 3 to extract the air according to the presetting characteristics until the vacuum chamber 10 is close to a vacuum state, where no gas exists in the fluid 90.

[0040] Step e, the punch holder 42 and the die holder 41 are driven to corresponding positions for contacting joint. The lifting module 8 drives the punch holder 42 to move down or the die holder 41 to move up for realizing locating the punch holder 42 and the die holder 41 at corresponding positions for contacting joint each other.

[0041] Step f, the peripheral circumferences of the upper and lower thin films 92, 91 are

hot-pressed for enveloping the fluid 90 therein under a vacuum condition. No bubbles exist thereat. The lifting modules 8 drives the sealing nip 5 to move down for hot-pressing the peripheral circumferences of the upper and the lower thin films 91, 92 and enveloping the fluid 90 therein.

[0042] Step g, the vacuum state of the vacuum chamber 10 is released for taking out the enveloped product. After the process of the hot-press enveloping, the vent hole 31 of the vacuum pump module 3 fills gas into the vacuum chamber 10 to release the vacuum state, and the valve 2 opens the housing 1 to release closing state of the vacuum chamber 10, and the moving module 7 drives the die holder 41 to move out the vacuum chamber 10. Thus, the hot-press enveloping product can be taken out.

[0043] The fluid 90 is enveloped between the upper and the lower thin films 92, 91 under a vacuum environment without any bubbles and air in the fluid 90 and leak between the two thin films 92, 91. Thus, the fluid enveloping device and the enveloping method do not need a manually squeezing operation for expelling bubbles and the air out of the enclosure through the opening, which can avoid bacterial or others contaminations, and improve the stability of the enveloped product through resolving separation of the fluid from the contact surfaces of the films under an abnormal circumstance. In addition, the operation time, the yield of product can be effectively improved and the cost can be lessened.

[0044] In other modifications, the sealing nip 5 can not only operate by hot melting adjoining method, but also operate by ultrasonic adjoining method or high-frequency adjoining method for hot-press enveloping fluid. The fluid 90 can be silicone gel or silicone rubber or their combination.

[0045] The above description is given by way of example, and not limitation. Given the above disclosure, one skilled in the art could devise variations that are within the scope and spirit of the invention disclosed herein, including configurations ways of the recessed portions and

materials and/or designs of the attaching structures. Further, the various features of the embodiments disclosed herein can be used alone, or in varying combinations with each other and are not intended to be limited to the specific combination described herein. Thus, the scope of the claims is not to be limited by the illustrated embodiments.

WHAT IS CLAIMED IS:

1. An fluid enveloping device comprising:

a housing having a vacuum chamber;

a valve for blocking off the communication of the vacuum chamber and atmospheric environment;

a vacuum pump module connected to the vacuum chamber for extracting air until the vacuum chamber is close to a vacuum state;

a die holder for locating a lower thin film and receiving the fluid at the lower thin film;

a punch holder for locating an upper thin film; and

a sealing nip in the vacuum chamber for hot-pressing the upper and the lower thin films to envelope the fluid therein.

2. The fluid enveloping device as claimed in claim 1, wherein the vacuum pump module comprises at least one air vent for extracting air until the vacuum chamber is close to a vacuum state or filling air into the vacuum chamber to relieve vacuum state.

3. The fluid enveloping device as claimed in claim 1, wherein the die holder is disposed out or in the vacuum chamber when the fluid is poured thereat.

4. The fluid enveloping device as claimed in claim 1, wherein the fluid is silicone gel or fluid silicone rubber or high temperature vulcanize (HTV) rubber or their combination.

5. The fluid enveloping device as claimed in claim 1, wherein the sealing nip operates by hot melting adjoining method, ultrasonic adjoining method or high-frequency adjoining method for hot-press enveloping fluid.

6. The fluid enveloping device as claimed in claim 1, wherein the sealing nip is located above the punch holder or under the die holder.

7. The fluid enveloping device as claimed in claim 1, further comprising a moving module for driving the die holder to move in and out the vacuum chamber.

8. The fluid enveloping device as claimed in claim 1, further comprising at least one lifting module in the vacuum chamber for driving the punch holder and the sealing nip to move down to contact join the die holder.

9. The fluid enveloping device as claimed in claim 1, further comprising at least one lifting module in the vacuum chamber for driving the die holder and the sealing nip to move up to contact join the punch holder.

10. The fluid enveloping device as claimed in claim 1, further comprising an operation module.

11. The fluid enveloping device as claimed in claim 10, further comprising two safety switches, which can control the valve being turned on or turned off, when the two safety switches are pressed simultaneously.

12. The fluid enveloping device as claimed in claim 10, wherein the operation module is used to adjust the air pump characteristics of the vacuum pump module or hot-pressing characteristics of the sealing nip.

13. A method of enveloping fluid comprising:

step a: locating an upper thin film at a punch holder;

step b: locating a lower thin film at a die holder;

step c: pouring a fluid at the lower thin film;

step d: sealing a vacuum chamber having the punch holder and the die holder;

step e: extracting the air in the vacuum chamber out until the vacuum chamber is close to a vacuum state;

step f: driving the punch holder and the die holder to corresponding positions for contact joint; and

step g: hot-pressing the peripheral circumferences of the upper and lower thin films for enveloping the fluid therein under a vacuum condition.

14. The method as claimed in claim 13, wherein the step of pouring the fluid at the lower thin film can be operated in or out the vacuum chamber.

15. The method as claimed in claim 14, wherein the die holder is moved in the vacuum chamber after the fluid is poured at the lower thin film out the vacuum chamber.

16. The method as claimed in claim 13, wherein the die holder is driven to move up to contact join the punch holder in step f.

17. The method as claimed in claim 13, wherein the punch holder is driven to move down to contact join the die holder in step f.

18. The method as claimed in claim 13, wherein a valve is provided to block off the communication of the vacuum chamber and atmospheric environment in step d.

19. The method as claimed in claim 18, further comprising a step of simultaneously pressing two safety switches for turning on or turning off the valve.

20. The method as claimed in claim 13, further comprising a step of the vacuum state of the vacuum chamber being released for taking out the enveloped product.

21. The method as claimed in claim 13, wherein the hot-press enveloping method can be hot melting adjoining method, ultrasonic adjoining method or high-frequency adjoining method for hot-press enveloping fluid.

22. The method as claimed in claim 13, wherein the fluid can be silicone gel or silicone rubber or high temperature vulcanize (HTV) rubber or their combination.

23. A fluid enveloping device substantially as hereinbefore described with reference to the drawings.

24. A method of enveloping fluid, substantially as hereinbefore described with reference to the drawings.

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Application No: GB0718744.6 **Examiner:** Mr Michael Young

Claims searched: 1-24 **Date of search:** 30 October 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-9, 13-18, 20-22	GB 2257387 A (EUROMALL..) Whole document relevant. See in particular fig.4 & corresponding passages.
X	1-9, 13-18, 20-22	US 6623588 B1 (RASMUSSEN) Whole document relevant. See in particular figs.2,3,5 & corresponding passages.
A	-	US 4249975 A (RECHENBERG)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A61F; B29C

The following online and other databases have been used in the preparation of this search report

WPI EPODOC

International Classification:

Subclass	Subgroup	Valid From
B29C	0039/20	01/01/2006
A61F	0002/12	01/01/2006
B29C	0065/02	01/01/2006